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SEPTEMBER 1984 NUMBER 193

MONTHLY REPORT

ON THE NUCLEAR FUEL MARKET

NUEXCO

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MONTHLY REPORT ON THE NUCLEAR FUEL MARKET

September 1984 No. 193

R. WESLEY MILLER, *EDITOR* CLARK M. BEYER, *ASSISTANT EDITOR*

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To Our Readers

Nuexco is pleased to announce that Mr. **James J. Lightner** is moving to our European office this month, where he will be an Associate. Jim has been the Associate Editor of the Monthly Report for the past nine months.

James J. Lightner

We are also pleased to announce that Ms. **Kathleen Rouhota** has joined Nuexco's Atlanta office as an Associate. Kathleen is a recent honors graduate of Georgia Institute of Technology, having earned a B.S. in Industrial Management. Kathleen is a native of Greece, and speaks Greek, French, and English fluently.

Kathleen Rouhota

* * *

Nuexco will host a hospitality suite during the Atomic Industrial Forum's Uranium Seminar in Keystone, Colorado, September 30 to October 3. We look forward to seeing you there.

* * *

As of September 1, 1984, Nuexco's Menlo Park office will no longer be using TWX number 910-373-1760. We can still be reached via telex number 470674, answerback NUEXCO UI.

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NATURAL URANIUM AND SECONDARY MARKET CONVERSION

The **Exchange Value** as of August 31, 1984 is **$17.50** per pound U_3O_8, unchanged since last month. The *Current Market Data* section of this Report lists four uranium sales transactions, involving a total of approximately 1.0 million pounds U_3O_8 *equivalent*. One of those sales involved natural UF_6.

Active supply of natural uranium (U_3O_8 and UF_6) for spot or near-term delivery totals **5.1 million** pounds U_3O_8 or equivalent UF_6, up 2.2 million pounds since last month. The corresponding figure for **active demand** is **1.1 million** pounds, up approximately 200 thousand pounds. The spot and near-term **supply-demand ratio** rose to **4.6:1.**

The **Transaction Value** as of August 31, 1984 is **$16.40** per pound U_3O_8, down $0.20 since last month. The current Transaction Value includes 10 transactions involving a total of 3.9 million pounds U_3O_8 or equivalent UF_6 and covers a period of 4 months. While all four of the transactions reported this month involved deliveries before 1986, only one of them met the criteria for inclusion in the current Transaction Value calculation.

The **Loan Use Charge Rate** as of August 31, 1984 is **6 percent** per annum, unchanged since last month, in a nearly dormant market.

* * *

The Exchange Value is unchanged at $17.50; material is still available for sale at or below that level, particularly in small lots. The virtual absence of active buyers for significant quantities in recent weeks forestalled the development of any impetus for upward price movement. Downward price pressure was largely attributable to lots of less than 100,000 pounds U_3O_8. Under other circumstances, such small lots might have been significant, but as of the end of August significant quantities amounted to 200,000-300,000 pounds. The actions of one or two potential buyers of large quantities of material (upwards of one million pounds U_3O_8) could cause substantial price movements in the next several months, especially if sellers offer insufficient quantities at current prices. Substantial supplies are, of course, available at higher prices, but whether such prices will materialize largely depends on how the buyer(s) approach the market. Rapid, aggressive procurement efforts probably would lead to price firming, while a more measured approach could well leave market prices relatively unchanged. Finally, given time to exploit the leverage created by a large purchase, the buyer(s) might be able to negotiate aggressively enough to force the price down further.

The sharp increase in uranium supply this month is attributable primarily to the addition of a few large producers offering substantial quantities of material for near-term delivery. Several other potential sellers, including producers and users having large unneeded inventories, are awaiting the appearance of firm demand, at which time they will compete to conclude sales.

* * *

The **Conversion Value** is **$0.80** per pound U as UF_6, up from $0.00, due to the August reemergence of a substantial quantity of active conversion demand. Furthermore, unlike last month, sellers of natural UF_6 are presently able to compete with U_3O_8 sellers without the need to discount to zero the value of the conversion component associated with their material.

Active supply of secondary market conversion services for delivery within three years amounts to 2.8 million pounds U in UF_6. Active secondary market conversion demand for delivery within these years totals 845 thousand pounds U as UF_6. No secondary market conversion transactions are reported.

SECONDARY MARKET ENRICHMENT SERVICES

The **SWU Values** as of August 31, 1984 are **$100** for **DOE origin** and FY85 delivery, up $5, and **$85** for **non-DOE origin** and delivery within approximately 15 months, unchanged. The *Current Market Data* section of this Report lists six secondary market SWU sales, involving approximately 700,000 SWUs. Two of those transactions involved SWUs of Eurodif origin. Active near-term SWU supply on the secondary market amounts to 215,000 SWUs, while active demand amounts to 325,000 SWUs.

The DOE origin SWU Value rose this month as the available supply of secondary market SWUs for FY85 delivery fell below the current demand, and some of the remaining active sellers increased their offering prices. Most of the currently active buyers seek relatively small quantities of SWUs to fill requirements for the coming fiscal year, but many are hesitating to act until they make final long-term enrichment contracting decisions. The deadline given to DOE customers for their decision to convert to the Utility Services enrichment contract (USEC) is October 1, 1984, so many market participants will be making those decisions during September. Demand on the secondary market could increase substan-

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tially thereafter. The non-DOE origin SWU Value remained unchanged at $85 per SWU, so the differential relative to the DOE value increased to $15 per SWU. That differential represents the additional incentive demanded by buyers that are free to buy SWUs of any origin.

Activity is increasing in the secondary market for FY86 SWUs, as indicated by the fact that three of the six SWU transactions reported this month involved FY86 SWUs. Prices vary widely, as do payment terms; generally, FY86 SWUs are being priced at $18–20 discounts relative to the USEC price.

* * *

Since January of 1984, in its continuing effort to preserve its customer base in the primary enrichment market, DOE has been offering price concessions to customers that convert or express their intent to convert their existing DOE contracts to the USEC. Requirements customers that have notified DOE of their intent to convert to the USEC have been able to take FY84 deliveries at $135.00 per SWU, rather than the $149.85 per SWU that currently applies to DOE SWUs under Requirements contracts. (As of October 1, the Requirements *contract price* will rise from $149.85 to the lower of the new *published price* of $157.00 per SWU, or the new *ceiling charge*, which probably will fall slightly below the published price.) Fixed-commitment contract prices will rise to $153.00 per SWU on October 1, so the DOE price concession to those customers converting to the USEC will rise from the present level of $3.65 per SWU to $18.00 per SWU.

Nuexco is aware of eleven utilities that, as of August 31, had actually signed the USEC: Carolina Power & Light Co., Commonwealth Edison Company, Dairyland Power Cooperative, Detroit Edison Co., Duke Power Co., Houston Lighting and Power Company, Philadelphia Electric Co., Public Service Electric and Gas Co., Tennessee Valley Authority, Washington Public Power Supply System, and Chubu Electric Power Company (Japan). Table 1 shows an update of DOE customers' status on conversion to the USEC. Arranged by MWe of generating capacity within buyer regions, it indicates that DOE will be successful in retaining almost all of its US and Japanese customers, while losing much of its market share in Europe.

It appears, as expected, that DOE will succeed in converting to the USEC contracts covering at least 84 percent of US nuclear generating capacity now covered by DOE contracts, and possibly as much as 100 percent. Although DOE cannot expect to supply 100 percent of requirements for all the reactors covered by conversion to the USEC, of the US utilities that have signed the contract, only Commonwealth Edison has signed for less than the full 100 percent of enrichment needs. Thus, the actual DOE share of the US enrichment market probably will exceed 70 percent.

Nuexco expects that, in addition to Chubu Electric Power Company, all of DOE's Japanese customers eventually will convert, and they generally are very interested in the possibility of purchasing less than 100 percent from DOE. However, their final decisions have become more dependent upon the prospect of incremental SWU pricing ($60 to $85 per SWU) currently under review at DOE and reported in several technical publications. Such proposals would apply only to the 30 percent of utilities' requirements that need not be covered by the USEC.

Present indications are that customers representing at least 50 percent (14.6 MWe) of the European generating capacity now supplied by DOE (29.2 MWe) will refuse to convert to the USEC. Customers representing one-sixth of the total will convert, and the remaining one-third of the total is as yet uncertain. Approximately one-half (7.2 MWe) of the capacity in the *Indicated Will Not Sign* category is covered by Requirements contracts, so it is likely DOE will lose virtually that entire amount.

Given the competition among DOE, Eurodif (represented by Cogema), and Urenco, many utilities have delayed making any decision regarding the USEC until they have reviewed the most recent offering prices. For now, DOE has not made any firm offers of incrementally-priced SWUs, but their tactic has indeed forestalled consideration of non-DOE offers at some utilities, especially in the USA and Japan.

Correction

Last month's Report listed a secondary market sale of enrichment services incorrectly. For Nuexco reference number 2972D (page 6, Report #192), the quantity should have been shown as "101-300," rather than "less than 50."

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Table 1

REGIONAL STATUS OF CONVERSION TO USEC
(Expressed in GWe of Generating Capacity)

Current Status	Former Status: Requirements Contracts 3.5-year	Former Status: Requirements Contracts 5-year	Former Status: Fixed-Commitment Contracts
USA			
Signed	16.1	13.4	15.2
Indicated Intent to Sign[1]	8.3	16.2	26.0
No Indication	7.3	3.5	7.1
Indicated Will Not Sign	0.5	—	—
Europe			
Signed	—	—	—
Indicated Intent to Sign[1]	0.6	0.6	3.7
No Indication	1.0	—	8.7
Indicated Will Not Sign	6.2	1.0	7.4
Japan			
Signed	0.5	—	1.9
Indicated Intent to Sign[1]	3.1	5.6	13.0
No Indication	—	—	—
Indicated Will Not Sign	—	—	—
Other			
Signed	—	—	—
Indicated Intent to Sign[1]	—	—	8.5
No Indication	—	—	0.6
Indicated Will Not Sign	—	—	—

[1]Category is not limited to "letters of intent" that DOE has received, but also includes general expressions of interest.

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CURRENT MARKET DATA

August 31, 1984	Market Values	Active Supply[1] (thousands)	Active Demand[1] (thousands)
EXCHANGE VALUE	**$17.50**/lb. U_3O_8	5,055	1,050
CONVERSION VALUE	**$0.80**/lb. U in UF_6	2,825	845
SWU VALUES			
DOE origin, FY85 delivery	**$100**/SWU	215	325
non-DOE origin, delivery within 15 months	**$85**/SWU		
LOAN USE CHARGE RATE	6%/annum	0	0

TRANSACTION VALUE	$/lb. U_3O_8	Millions of Pounds	Number of Transactions	Number of Months
	16.40	3.9	10	4

[1]Supply and demand tables in the *Current Market Data* section of this Report detail the numbers for each category. Quantities of SWUs (Separative Work Units) are not referenced to a particular origin.

DEFINITIONS

1. The **Exchange Value** is Nuexco's judgment of the price at which transactions for significant quantities of natural uranium concentrates could be concluded as of the date indicated.
2. The **Conversion Value** is Nuexco's judgment of the price at which spot and near-term transactions for significant quantities of conversion services could be concluded in the secondary market as of the date indicated.
3. The **SWU Values** represent Nuexco's judgment of the price at which transactions for the sale of significant quantities of SWUs of stated origin for delivery in the specified time period could be concluded as of the date indicated.
4. The **Loan Use Charge Rate** is Nuexco's judgment of the annual interest rate at which uranium loans could be concluded as of the date indicated.
5. The **Transaction Value** is a weighted average price of recent natural uranium sales transactions. The calculation is based on prices paid in:
   a. Transactions closed within the previous three-month period for which delivery is scheduled within one year of the transaction date;
   b. At least ten transactions;
   c. Transactions involving a sum total of at least 2 million pounds U_3O_8 equivalent.

   The sample time is extended as necessary to include these minima. Other currencies are converted to US dollars using conversion rates in effect on or near the transaction date.

DERIVATIONS AND COMMENTS

1. All Market Values are based on:
   a. Data from recently completed transactions.
   b. Data from pending transactions.
   c. Firm bids to buy or borrow, and firm offers to sell or lend.
   d. Prices purchasers or rates borrowers have expressed a willingness to pay, but for which Nuexco is not aware of firm bids to buy or borrow, and prices sellers or rates lenders have expressed a willingness to offer, but for which Nuexco is not aware of firm offers to sell or lend.
2. Prices associated with deliveries under old or renegotiated contracts or other than arm's-length transactions are not considered in the determination of these Market Values.
3. In the determination of the Conversion Value, Nuexco does not consider transportation charges other than those customarily provided by primary suppliers of conversion services.
4. The prices of conversion services or SWUs delivered under long-term contracts with primary suppliers are not considered in the determination of either the Conversion Value or SWU Value.
5. For the SWU Values, Nuexco converts SWU prices at varying tails and product assays to equivalent SWU prices at the DOE Reference Transaction Tails Assay (presently 0.20 weight-percent U_{235}) and a product assay of 3.0 weight-percent U_{235}, assuming feed costs corresponding to Nuexco's Exchange and Conversion Values determined as of the same date.
6. In calculating the Transaction Value, Nuexco does not account for the price of uranium delivered in connection with contracts which call for "market price" mechanisms. This exclusion applies particularly to contracts in which delivery prices are expressed as a function of future Exchange Values or any other indeterminant variable. Also excluded from the calculation are any other transactions in which the delivery price is defined in such a way that it cannot currently be determined.

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CURRENT MARKET DATA

EXCHANGE VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

Country (currency)	per lb. U_3O_8 in Concentrates			per kg. U in Concentrates		
	This Month (August 31, 1984)	Last Month (July 31, 1984)	12 Months Ago (August 31, 1983)	This Month (August 31, 1984)	Last Month (July 31, 1984)	12 Months Ago (August 31, 1983)
Australia (dollar)	20.60	21.08	27.28	53.56	54.81	70.93
Belgium (comm. franc)	1,018	1,023	1,294	2,647	2,661	3,364
Canada (dollar)	22.71	23.01	29.58	59.03	59.82	76.90
Finland (markka)	105.87	106.58	137.58	275.23	277.08	357.66
France (franc)	154.87	155.42	194.11	402.62	404.05	504.65
FRG (mark)	50.49	50.64	64.48	131.26	131.64	167.64
Italy (lira)	31,418	31,117	38,523	81,681	80,896	100,152
Japan (yen)	4,220	4,304	5,911	10,971	11,189	15,368
Netherlands (guilder)	56.91	57.23	72.17	147.95	148.78	187.62
South Africa (rand)	27.34	28.62	26.96	71.09	74.40	70.09
Spain (peseta)	2,884	2,861	3,647	7,498	7,439	9,482
Sweden (krona)	145.11	146.81	187.74	377.25	381.68	493.29
Switzerland (franc)	41.96	43.08	52.39	109.08	112.00	136.21
UK (pound)	13.34	13.37	16.02	34.68	34.77	41.64
US (dollar)	17.50	17.50	24.00	45.50	45.50	62.39

TRANSACTION VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

Country (currency)	per lb. U_3O_8 in Concentrates			per kg. U in Concentrates		
	This Month (August 31, 1984)	Last Month (July 31, 1984)	12 Months Ago (August 31, 1983)	This Month (August 31, 1984)	Last Month (July 31, 1984)	12 Months Ago (August 31, 1983)
Australia (dollar)	19.31	20.00	26.83	50.19	52.00	69.75
Belgium (comm. franc)	954.04	970.76	1,272	2,480	2,524	3,308
Canada (dollar)	21.28	21.82	26.09	55.32	56.74	75.62
Finland (markka)	99.21	101.10	135.28	257.93	262.83	351.70
France (franc)	145.13	147.42	190.88	377.31	383.27	496.24
FRG (mark)	47.32	48.03	63.41	123.01	124.87	164.84
Italy (lira)	29,443	29,516	37,881	76,546	76,736	98,483
Japan (yen)	3,955	4,083	5,813	10,281	10,614	15,112
Netherlands (guilder)	53.33	54.28	70.97	138.65	141.13	184.50
South Africa (rand)	25.63	27.15	26.51	66.62	70.57	68.92
Spain (peseta)	2,703	2,714	3,587	7,026	7,056	9,324
Sweden (krona)	135.99	139.26	186.58	353.54	362.05	485.07
Switzerland (franc)	39.32	40.87	51.52	102.22	106.24	133.94
UK (pound)	12.50	12.69	15.75	32.50	32.98	40.94
US (dollar)	16.40	16.60	23.60	42.64	43.16	61.35

[1]Calculated using currency exchange rates published in the *Wall Street Journal* on August 31, 1984.

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CURRENT MARKET DATA

CONVERSION VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

Country (currency)	per lb. U as UF_6			per kg. U as UF_6		
	This Month (August 31, 1984)	Last Month (July 31, 1984)	12 Months Ago (August 31, 1983)	This Month (August 31, 1984)	Last Month (July 31, 1984)	12 Months Ago (August 31, 1983)
Australia (dollar)	0.94	0.00	1.25	2.08	0.00	2.76
Belgium (comm. franc)	46.54	0.00	59.30	102.60	0.00	130.73
Canada (dollar)	1.04	0.00	1.36	2.29	0.00	2.99
Finland (markka)	4.84	0.00	6.31	10.67	0.00	13.90
France (franc)	7.08	0.00	8.90	15.61	0.00	19.61
FRG (mark)	2.31	0.00	2.96	5.09	0.00	6.52
Italy (lira)	1,436	0.00	1,766	3,166	0.00	3,893
Japan (yen)	192.91	0.00	270.94	425.29	0.00	597.31
Netherlands (guilder)	2.60	0.00	3.31	5.74	0.00	7.29
South Africa (rand)	1.25	0.00	1.24	2.76	0.00	2.72
Spain (peseta)	131.84	0.00	167.17	290.66	0.00	368.55
Sweden (krona)	6.63	0.00	8.70	14.62	0.00	19.17
Switzerland (franc)	1.92	0.00	2.40	4.23	0.00	5.29
UK (pound)	0.61	0.00	0.73	1.34	0.00	1.62
US (dollar)	0.80	0.00	1.10	1.76	0.00	2.43

SWU VALUES EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

Country (currency)	DOE SWU FY85 (August 31, 1984)	DOE SWU FY85 (July 31, 1984)	Non-DOE SWU delivery within 15 months (August 31, 1984)	Non-DOE SWU delivery within 15 months (July 31, 1984)
Australia (dollar)	117.72	114.46	100.06	102.41
Belgium (comm. franc)	5,817	5,556	4,945	4,971
Canada (dollar)	129.75	124.90	110.29	111.75
Finland (markka)	604.96	578.56	514.22	517.66
France (franc)	884.96	843.69	752.21	754.88
FRG (mark)	288.52	274.88	245.24	245.95
Italy (lira)	179,533	168,919	152,603	151,138
Japan (yen)	24,114	23,364	20,497	20,905
Netherlands (guilder)	325,20	310.66	276.42	277.96
South Africa (rand)	156.25	155.36	132.81	139.00
Spain (peseta)	16,480	15,533	14,008	13,898
Sweden (krona)	829.19	796.98	704.81	713.09
Switzerland (franc)	239.75	233.87	203.79	209.26
UK (pound)	76.22	72.60	64.79	64.96
US (dollar)	100.00	95.00	85.00	85.00

[1]Calculated using currency exchange rates published in the *Wall Street Journal* on August 31, 1984.

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RECENT TRANSACTIONS[1]

Uranium Sales

Nuexco Transaction Number	Delivery Period	Approximate Quantity (thousands of pounds, U_3O_8 equivalent)	Approximate Price as Percent of Current E.V.	Seller	Buyer	Remarks
3110	1984	50-100	93	European Entity	US Utility	
3103	1984-85	601-1,000	97-103	Canadian Producer	US Utility	
3091	1984	50-100	unknown	European Broker	US Utility	UF_6.
3088	1984	101-300	indeterminate	US Producer	US Producer	Price related to market.

Secondary Market Enrichment Services

Nuexco Transaction Number	Delivery Period[2]	Approximate Quantity[3] (thousands of SWUs)	Approximate Price[4] as Percent of Current SWU Value[5]	Seller Group	Buyer Group	SWU Origin	Remarks
3106	1987-89	301-600	106-135	European Entity	US Utility	Eurodif	Fixed prices. Tails assay 0.20% 0.29%.
3102	1986	101-300	see remarks	European Utility	US Utility	DOE	Discount off DOE price.
3090	1984	less than 50	100	US Utility	US Utility	DOE	0.26% tails assay.
3084	1985	50-100	104	US Utility	European Trader	DOE	0.3% tails assay. Deenrichment swap.
3076	1986	50-100	100	European Entity	US Utility	Eurodif	
3075	1986	50-100	105	US Utility	non-US Utility	DOE	

[1] Transactions listed are not limited to those in which Nuexco was involved, but also include others of which Nuexco is aware.
[2] Refers to calendar year, not fiscal year.
[3] If tails assay is unknown or unspecified, Nuexco's calculation of SWU quantity assumes 0.20 w o tails assay.
[4] Price is not normalized to 0.20% tails assay.
[5] Refers to SWU Value for same origin as SWUs included in transaction.

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CURRENT MARKET DATA

URANIUM SUPPLY
(As of 8/31/84)

Nuexco Project Number	Delivery Period[1] (Thousands of Pounds U_3O_8) Spot or Near-term[2]	Intermediate or Long-term	Remarks
Available for Sale:			
ACTIVE			
1575*	500	500 per year	
1818	—	500 per year	1985-90
1860*	400	1,500 per year	
2038*	1,000	1,000 per year	UF_6
2201*	300	—	
2236	—	200 per year	1985-89
2263	—	500 per year	1985-90
2275*	150	—	
2288	45	—	UF_6
2326*	—	1,000 per year	1989-91
2336	—	250 per year	
2368	—	2,800	
2392	35	—	UF_6
2429*	800	—	
2484	130	—	
2489	—	500	1986-90
2499*	15	—	
2509	1,200	1,600	UF_6
2521*	80	100	U_3O_8 or UF_6
2565	400	—	
TOTAL:	5,055		
INACTIVE			
0564	—	1,000 per year	1985-90
2191	125	—	UF_6
2193	—	800 per year	1986-90
2271	—	500 per year	1984-88
2297	—	200 per year	1985-89
2389	300	—	
2473	—	500 per year	1984-90
2495	130	—	UF_6
2514	—	1,000 per year	
2553	300	—	
2556*	350	—	UF_6
TOTAL:	1,205		

*New or revised since last month.
[1]Measured from the date of this Report.
[2]For delivery within one year. This category excludes material deliverable within one year under other than spot or near-term contracts.
Projects removed since last month: 2315.

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URANIUM DEMAND
(As of 8/31/84)

Nuexco Project Number	Delivery Period[1] (Thousands of Pounds U_3O_8) Spot or Near-term[2]	Intermediate or Long-term	Remarks
Inquiries to Purchase:			
ACTIVE			
2217	—	1,000 per year	1988-95
2506	50	—	U_3O_8 or UF_6
2528	—	250 per year	1991 on
2555*	—	150 per year	1986-89
2563*	1,000	—	UF_6
TOTAL:	1,050		
INACTIVE			
1999	—	50 per year	1985-90
2244*	—	350 per year	1987 on
2329*	—	500	1985
2414	—	150 per year	1987-91
2442	—	250 per year	1986 on
2457*	—	350 per year	1988 on
2507	—	300	1987-88
2542A*	—	1,400	1990; UF_6e
TOTAL:	—		

*New or revised since last month.
[1]Measured from the date of this Report.
[2]For delivery within one year. This category excludes material deliverable within one year under other than spot or near-term contracts.
Projects removed since last month: 2352, 2456.

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CURRENT MARKET DATA

LOAN SUPPLY AND DEMAND
(As of 8/31/84)

Nuexco Project Number	Delivery Period[1] (Thousands of Pounds U_3O_8) Within 1 Year	Beyond 1 Year	Remarks
Available for Loan:			
INACTIVE			
1938*	2,000	—	UF_6
2128*	500	—	
2139*	2,000	—	
2483*	550	—	
TOTAL:	5,050		

*New or revised since last month.
[1]Measured from the date of this Report.

CONVERSION SUPPLY AND DEMAND
(As of 8/31/84)

Nuexco Project Number	Delivery Period[1] (Thousands of Pounds U as UF_6) Within 3 Years	Beyond 3 Years	Remarks
Available for Sale:			
ACTIVE			
2141	2,600	—	
2560*	225	—	
TOTAL:	2,825		
INACTIVE			
2051	1,000	—	
2401	600	—	
2438	500	250	1985-87
2511	600	700	1986-90
TOTAL:	2,700		
Inquiries to Purchase:			
ACTIVE			
2456B*	845	—	
TOTAL:	845		
INACTIVE			
2420*	300	—	1986
TOTAL:	300		

*New or revised since last month.
[1]Measured from the date of this Report.

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CURRENT MARKET DATA

SWU SUPPLY AND DEMAND
(As of 8/31/84)

Nuexco Project Number	Delivery Period[1] (Thousands of SWUs) Spot or Near-term[2]	Intermediate or Long-term	Remarks
Available for Sale:			
ACTIVE			
2100	—	100 per year	1986-87
2164	80	—	
2285	—	1,000	
2408*	—	65	1986
2428*	80	40	
2513*	—	25	1986
2550	55	—	
TOTAL:	215		
INACTIVE			
2192	10	—	
2510*	200	—	
TOTAL:	210		
Projects removed since last month: 2345, 2351.			
Inquiries to Purchase:			
ACTIVE			
2443*	70	—	
2452	30	—	1985
2454*	100	100	1986
2471*	—	40 per year	1986-90
2503	—	330	1986
2519	—	30 per year	1987 on
2543	10	20	1986
2562	15	30	1986
2564*	—	30	1986
2600*	100	—	
TOTAL:	325		
INACTIVE			
2449*	—	50	1987 on
2459*	—	50 per year	1987 on
2479	—	50	1986
2480*	100	—	
2512	—	15 per year	1987 on
2542B*	—	340	1990; UF_6e
2552	35	—	
TOTAL:	135		

*New or revised since last month.

[1]Measured from the date of this Report.

[2]For delivery within one year. This category excludes SWUs deliverable within one year under other than spot or near-term contracts.

Projects removed since last month: 2346, 2407, 2430, 2522.

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COMMENTARY

THE ROLE OF THE US GOVERNMENT'S URANIUM ENRICHMENT PROGRAM

by **J.R. Wolcott,** *Chairman and Chief Executive, Nuexco*

On August 16, 1984, J. Robert Wolcott testified before the Tricommittee Advisory Panel on Uranium Enrichment for the US House of Representatives, in Washington, D.C. The Advisory Panel consists of eight persons selected from outside the government, and was asked by the Congress to provide a report assessing the US enrichment program to the three congressional committees that influence enrichment policy and program funding. Mr. Wolcott's remarks are summarized below.

Nuexco provides brokerage, consulting and information services to clients having interests in the nuclear fuel market. Approximately two-thirds of Nuexco's business involves non-US companies. The policies and practices of the US DOE have a wide influence on the international market, and thus on Nuexco's business.

The theme I would like to concentrate on today is the need for a clear definition of the role of the US government's uranium enrichment program in the international market. I do not believe there is a universally accepted view of what that role is, or should be. The Congress, US utilities, and non-US utilities all have an interest in a clear and common understanding.

At the present time, the US government is attempting to increase (or at least maintain) its share of the international enrichment business. To achieve this goal, the government is combatting nationalism and competition with price reductions, while developing new technologies on a large scale. A clear definition of the role of the US enrichment program could demonstrate that the current set of market practices is not preferable.

Alternative Missions

The government needs to define a specific mission for DOE. In my view, there could be three options.

1. To operate as a *business.* The major indicators of business success are profitability, return on investment, and cash flow. Unfortunately, DOE cannot operate effectively as a private enterprise in the existing governmental environment. Political and institutional constraints and conflicts are too great. If DOE were to operate as a business, fundamental institutional restructuring would be necessary.

2. To operate as a *political instrument.* The primary mission would be to influence and control the policies of domestic companies and other nations. Political influence would outweigh economic results. In today's market, such a mission is impractical, because uranium enrichment technology is well-developed in at least eight countries outside the USA. In the past, attempts by the USA to control other nations' policies have been counterproductive. As for US companies, it is clear that they appreciate the services of the government, but resent overregulation or market obstruction.

3. To provide a *national service.* The mission would be to provide, effectively and efficiently, a national service that is not otherwise available. In my opinion, DOE should concentrate on this alternative—providing a high-quality national service. It is the only practical mission. Growth and bigness do not necessarily serve this purpose.

The Market for DOE's Services

There is an undeniable, apparent trend in other nations towards fuel supply independence. There are three successful commercial enrichment enterprises in Europe alone, and production facilities exist in five European nations. A production operation is being organized in Japan that will be owned by the Japanese utilities, the customers. Clearly, a private business in DOE's position would not plan its programs and investments on the assumption that a large foreign market for its services will continue. The plans would assume a declining non-US market.

Most US utilities prefer to take their enrichment services from DOE almost regardless of price. I see no possibility that DOE will not remain the dominant US supplier. There will be a large market for US enrichment services regardless of events outside the USA. The uncertainty facing DOE is not one of *survival;* it is one of *size.*

Competition for the US market has been beneficial. It has forced DOE to reduce costs and improve services. Secondary market competition, sales of enriched uranium and SWU commitments from users, has probably passed its peak, but it will continue and will provide a measure of market discipline. Primary market competition, long-term sales from non-US enrichment enterprises to traditional DOE customers, has only recently begun, but it also will continue to provide market discipline. I believe competition is a permanent and healthy feature of the international enrichment market.

Pricing

As part of its strategy of taking the offensive against other SWU sellers, DOE has recently discussed incremental, or marginal-cost, pricing. By definition, such pricing does not provide full-cost recovery. The media has inferred that DOE may sell SWUs in the range of $60-$80

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to be competitive with non-US SWU sellers.

It is difficult to understand the rationale for this strategy. Essentially, it reduces the cost of power for non-US manufacturers (the users of the power) while providing no tangible benefit—and potentially a large loss—to the US government. The difference between full cost and marginal cost must be recovered, in accordance with the prevailing law. Charging less than full cost now means that long-term customers of DOE must ultimately make up for losses. The only reliable long-term customers are US utilities.

Moreover, the USA from time to time has accused non-US suppliers of "dumping" on the US market. It seems to me there is an inconsistency in our position that needs an explanation. Can dumping by non-US companies be criticized fairly at the same time that DOE promotes marginal-cost pricing overseas?

Competition among the primary enrichment suppliers yields what I would call soft pricing. Governments control all of the suppliers, and none likes to retreat from a challenge. DOE, the highest-cost, highest-volume producer and the market leader, is now promoting a downward price spiral. In the past, every time DOE has made competitive price concessions that are expensive for the government, the competition has followed. DOE needs to exhibit price leadership in accordance with a clearly-defined mission.

Research, Development and Investment

A SWU is a SWU, no matter who produces it or by what method. The only practical focus of research and development is *cost reduction*. Before large investments in commercial-scale facilities are made, production costs for alternative processes must be known. Test facilities must provide the basis for accurate cost estimates. Moreover, institutional and organizational costs must be weighed. Different enrichment programs entail different management, labor, and political costs that are not technically dependent. Research and development programs must focus on providing accurate cost comparisons at the earliest date and at minimum cost.

The R&D programs should be examined from that point of view. Organizations can become caught up in the pursuit of expensive new technologies. We need to avoid a situation in which *theoretical* costs based on basic research are compared to *actual* costs based on truly relevant experience. The pace at which funding is provided for centrifuge and laser technology should be synchronized so that answers about costs come from both sources at approximately the same time. Those answers can be compared with the costs of the existing production method.

Conclusions

1. The theme I hoped to stress today was the need for a clear definition of the role of the US government's enrichment program, particularly in the international market. Is the enrichment program to function as a business, an instrument of policy, or a public service? One can neither criticize nor praise the program fairly unless one has a basis of measurement. That basis should be defined with a specific mission.

Once the mission is clarified, a number of questions can be answered, including:

How important is program size and market share?

What is the optimum production level? Which plants should be operated?

What are proper pricing strategies for US and non-US utilities? What does the US gain from them?

When should new facility investments be made? Who benefits from those investments?

2. DOE's problems are not unique. They are the result of the drying up of overseas markets with the growth of nationalistic competition. Numerous private businesses have gone through this evolutionary process. Many have adjusted and survived. DOE will survive more easily because of its strong base of nationalistic support.

3. There is always a danger of overreaction in a situation such as that facing the US government's enrichment program. It is a popular instinct to assume that "a good offense is the best defense." But that may not be the wisest approach. An organization such as DOE must constantly reevaluate its mission and formulate its strategy on the basis of its mission.

A Suggestion

I find in my own company that a board of directors including persons from outside the company is most useful. It focuses attention on the broader goals of the organization. It serves as a constant reminder to management that the aim of the business is not to serve management. It provides a perspective that those of us submerged in day-to-day operations do not always have.

An equivalent body may be useful to the US government. The purpose could be much the same as for a business corporation: evaluating policies and strategies, evaluating performance, representing shareholders' (taxpayers in this instance) interests. Perhaps with such an oversight body Congress would give DOE greater policy latitude and flexibility, which I believe it needs.

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ANALYSIS & COMMENTARY

ENRICHED URANIUM SALES: EFFECT ON URANIUM SUPPLY INDUSTRY

by **Richard K. Andersen,** *Vice President, Nuexco*

The following is a slightly edited version of a presentation made by Dick Andersen at the Uranium Institute's Ninth Annual Symposium in London on September 7, 1984.

Overview

Two recent unanticipated events have reduced by approximately 130 million pounds the previously expected demand for U_3O_8 during the period 1983–91. The two unexpected events have been:

1. secondary market sales of low-enriched uranium (LEU) inventories;
2. the offer of the Utility Services enrichment contract (USEC) by the US Department of Energy (DOE).

Nuexco's analysis indicates that 12 million pounds of the 130 million pound total potential demand reduction has already affected the U_3O_8 market, and that the remaining 118 million pounds could do so over the next seven years. Three principal market changes are causing this reduction.

1. The elimination of artificial demand created by prior enrichment contracts having fixed-commitment terms;
2. The net drawdown of existing inventories held by DOE customers;
3. Purchases of LEU on the secondary market by USEC customers from other holders of inventory.

Table 2 summarizes the effect of each of these three market changes on uranium demand expectations, as measured by feed delivery commitments to DOE in the Fall of 1983. Figure 1 illustrates the artificial demand created by prior DOE contracts (48 million pounds); Figure 2 illustrates the difference between reactor consumption and feed commitments under the USEC (70 million pounds)—a difference that can be compensated for by inventory reductions and sales of LEU on the secondary market. Figure 3 illustrates the total effect of the USEC on prior demand expectations (118 million pounds).

The extent to which (a) users actually reduce existing inventories, and (b) LEU is redistributed among users in the secondary market, will not be influenced simply by macroeconomic forces. Political and business factors affecting each user ultimately control the extent of market change. However, the overall implications for the uranium market of the market changes outlined above are clear.

1. The market price should remain relatively depressed for the next few years due to reductions in feed commitments and the overall drawdown of user inventories.
2. Thereafter the market for the supplier industry will be better defined, and a period of general stability will ensue.

Table 2

COMBINED EFFECT OF USEC TERMS AND LEU INVENTORY SALES ON U_3O_8 DEMAND, 1983–1991

Market Trend	Millions of Pounds U_3O_8
Elimination of artificial demand created by prior DOE contracts	48
Net drawdown of existing inventories held by USEC customers	38
Purchases of LEU by USEC customers from other holders of inventory	32
TOTAL	118

Development of LEU Inventories

Inventory accumulates at each stage of the nuclear fuel cycle. To understand the nature of demand, uranium suppliers must observe continually the flow of uranium through the stages and monitor the inventory accumulations.

For over a decade, the enrichment services market was served largely through fixed-commitment contracts. DOE offered a rigid type in 1973 and a somewhat more flexible type in 1979. The European enrichers, Eurodif, Urenco and Techsnabexport, usually contracted on a fixed-commitment basis as well. As a result, enrichment services (SWU) production exceeded consumption for many years, and resulted in the accumulation by users of large inventories of uranium in various forms.

The current size of LEU inventories can be gauged as a subset of total inventories. Commercial WOCA[1] inventories of U_3O_8, natural UF_6 and LEU are estimated by Nuexco at about 430 million pounds U_3O_8 equivalent by the end of 1984. This amounts to 4.5 years of forward con-

[1] *World Outside Centrally Planned Economic Areas.*

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Figure 1

FEED DEMAND FOR DOE CONTRACTS PRIOR TO USEC ISSUANCE
(Millions of Pounds U_3O_8)

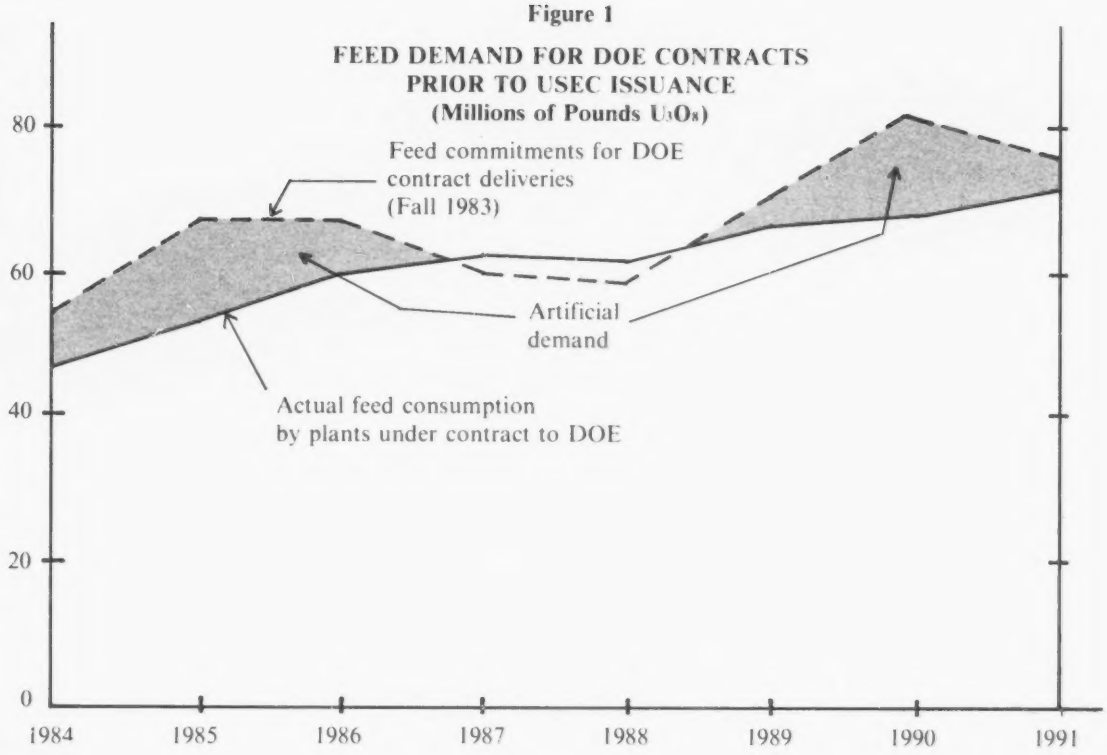
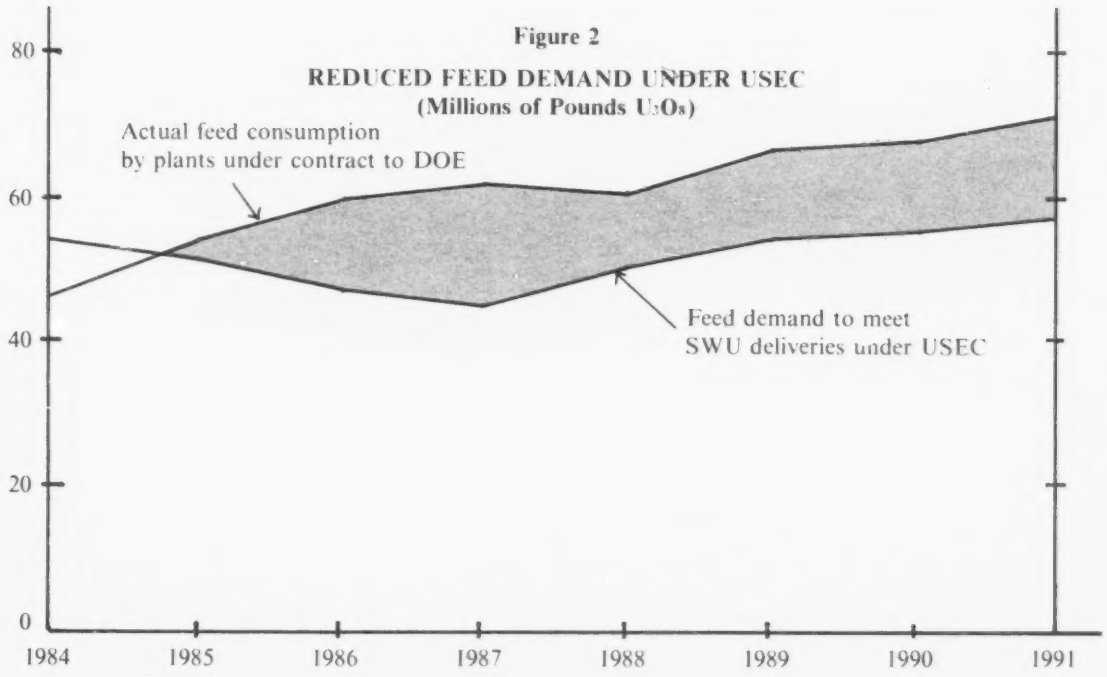


Figure 2

REDUCED FEED DEMAND UNDER USEC
(Millions of Pounds U_3O_8)



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sumption given current forecasts of nuclear power use. Of these inventories, the LEU portion is about 44 percent (190 million pounds U_3O_8 equivalent), just over 2 years of forward consumption.

Inventory holders accumulated excesses for different reasons. Some national entities had joined France in the ownership of the Eurodif enrichment plant based on expectations of large nuclear programs. As these programs failed to materialize, LEU inventories began accumulating in Europe. In the USA, as nuclear plants were delayed or canceled, many utilities also accumulated LEU inventories. Utilities that canceled all their nuclear plants had no need for their inventories and sold them. Utilities that encountered long plant construction delays have to date not sold LEU, but this is expected to change soon. Large LEU inventories also accumulated in Japan, where security of supply is an important consideration.

With additional deliveries arriving and others scheduled to arrive, buyers made attempts to curtail inventory growth. Eurodif reduced production and renegotiated some delivery schedules. Following these adjustments, it was expected that inventories gradually would be consumed by their owners. The development of a large LEU secondary market was not generally anticipated.

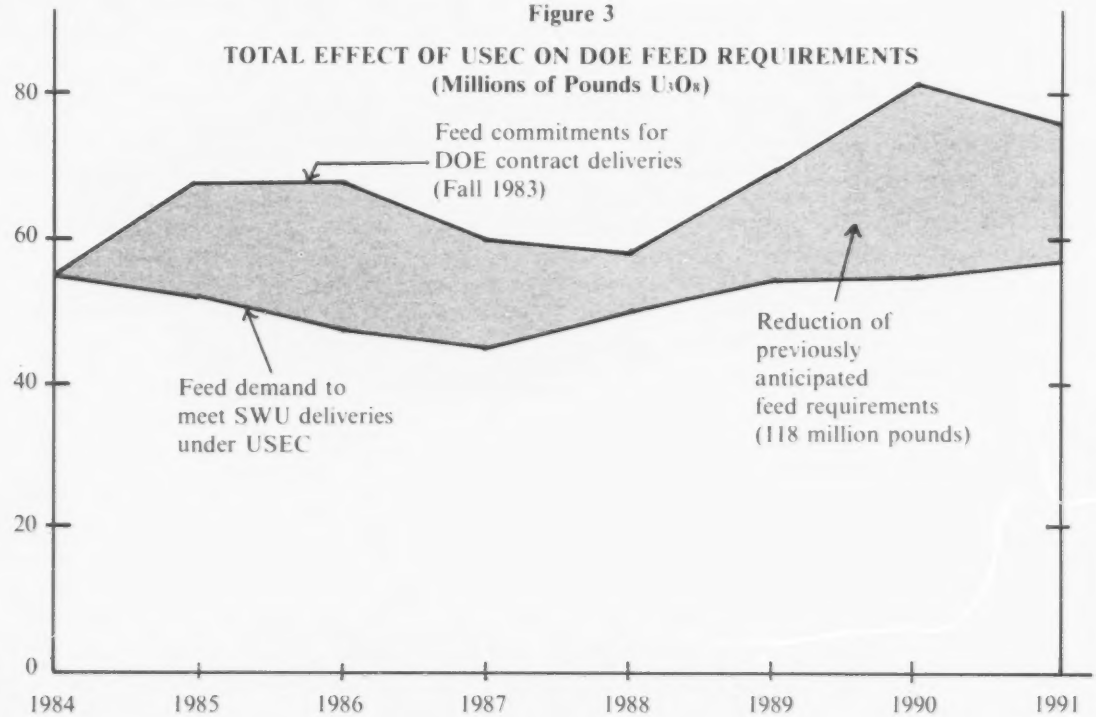
However, holding large excess LEU inventories is expensive. In early 1983, a few inventory holders elected to offer LEU at low prices. Those prices were sufficiently low that certain DOE customers found it profitable to cancel and pay termination penalties on their enrichment deliveries, and then buy from inventory sellers on the secondary market. This created a market outlet for excess material. Other inventory holders began to participate in the market, and LEU inventory selling gained momentum. To date, about 12 million pounds U_3O_8 equivalent have been sold on the secondary market as LEU or as its natural UF_6 component.

Effect of USEC

As secondary market selling of inventories gained momentum, DOE became increasingly alarmed at its lost enrichment business. It tried several methods to curtail delivery terminations. In January 1984, it issued the USEC,

Figure 3

TOTAL EFFECT OF USEC ON DOE FEED REQUIREMENTS
(Millions of Pounds U_3O_8)



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a requirements-type contract. The USEC was developed to stabilize business and sustain future revenue. The issuance of the USEC had the immediate effect of causing contract holders to stop procurement activities and evaluate future desired action, thus slowing the rate of LEU inventory sales.

The USEC will have lasting effects on the U_3O_8 market. In the longer term, it will assist in stabilizing the uranium market, because feed requirements will be more closely matched to reactor consumption. In the shorter term, it will allow utilities to delay the procurement of natural uranium.

There are six anticipated changes in the uranium market, including the three enumerated in Table 2, caused by the USEC. Four changes are negative for the supplier industry, one has little effect, and the last slightly helps U_3O_8 suppliers outside the USA.

1. The USEC eliminates artificial demand driven by DOE fixed-commitment enrichment contracts, thus *reducing* utilities' current and future U_3O_8 needs to the level of uranium consumption in their power plants.

2. It facilitates the drawdown of existing LEU inventories, either under the specified terms of conversion to the USEC or through additional concessions made by DOE in contract negotiations, again *reducing* the utilities' future U_3O_8 needs where excess inventories are available.

3. It permits the purchase of LEU inventories after 1986 in amounts up to 30 percent of requirements without termination charges, thus providing an opportunity for *reducing* U_3O_8 supplier sales.

4. It requires the payment of a premium for a buyer's election of a tails assay higher than 0.20 weight percent, although this will probably have only a small effect on U_3O_8 feed requirements.

5. It has resulted in the delay of some U_3O_8 purchases until utilities decide whether to convert to the USEC, thus invoking an unexpected moratorium on U_3O_8 purchases for many utilities through most of 1984.

6. The prospect of US sales has led European enrichers to make attractive offers to US utilities, thus broadening the utilities' commercial perspectives and somewhat reducing their inherent "Buy American" attitudes.

It can be argued that, had DOE not issued the USEC, secondary market sales of LEU material would have continued unabated with worse near-term effects on U_3O_8 sales. The USEC provides important relief mechanisms by which many utilities can:

1. delay LEU deliveries and, as a consequence, U_3O_8 feed procurement;

2. purchase LEU material, thus allowing inventory sellers to compete with other suppliers.

The following paragraphs review each of the principal effects, so as to provide clearer perspective on the role of LEU inventory sales and the DOE offer of the USEC.

Elimination of Artificial Demand

The USEC was designed as a requirements contract to entice all existing contract holders to convert to uniform terms. It gradually reduces the overcommitments of prior (Adjustable Fixed-Commitment) contracts. For those utilities electing to contract for 100 percent of their needs under the USEC, deliveries should closely match nuclear plant consumption. Figure 1 compares the worldwide U_3O_8 feed deliveries expected by DOE in the Autumn of 1983 with estimated U_3O_8 consumption by plants under DOE contract.

The USEC reduces U_3O_8 requirements associated with enrichment contracts by about 48 million pounds U_3O_8 over the seven-year period from 1985 to 1991. This reduction is equivalent to about 6 months of current worldwide U_3O_8 production. The artificial demand, had it occurred, would have resulted in inventory buildup. To work off that inventory it would have had to be applied against reactor consumption in later years. Thus, long-term demand is stabilized by the short-term drawdown of inventory created by artificial demand.

In the Autumn of 1983, anticipated DOE delivery commitments in later years might have been too optimistic. Some of the artificial demand three or more years into the future might have been terminated in any event, and, to that extent, the 48 million pounds U_3O_8 is overstated somewhat.

Drawdown of LEU Inventories

An attractive feature of the USEC is the option to purchase less than full SWU requirements. The contract terms, with certain restrictions, permit the utility to select between 70 and 100 percent of its needs. In addition, during contract negotiations, DOE has made concessions for less than 70 percent of deliveries in earlier years in exchange for larger deliveries in later years.

Allowing for restrictions and expected negotiated agreements, Nuexco judged that DOE contract holders in the USA and the Far East would contract from DOE for about 80 percent of requirements in 1985, 72 percent in 1986, and 85 percent in 1987 and beyond. Most European holders of DOE contracts were expected not to convert to the USEC.

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Thus, DOE contract holders with excess inventories will likely commit for less than 100 percent of their requirements in certain years. They can then draw down their inventories in those years. The drawdown reduces the current need for enrichment services and associated U_3O_8 requirements.

The worldwide effect of DOE feed requirements under the USEC compared with consumption for these contract holders is shown in Figure 2. The difference between the two curves amounts to about 70 million pounds U_3O_8 equivalent over the seven-year period. Of that amount, Nuexco estimates net drawdown of user inventories at 38 million pounds U_3O_8 equivalent.

Over the forecast period, there are some utilities that will draw down while other utilities will build up inventories. Drawdown comes from each utility's consumption of its own existing LEU inventories. Nuexco estimated the amount attributable to inventory drawdown at about 50 million pounds U_3O_8. Inventory buildup occurs where certain utilities have DOE commitments in 1984 and 1985 in excess of their needs. For some utilities, conversion to the USEC will not fully relieve these commitments. Note in Figure 2 that DOE deliveries in 1984 exceed consumption. This buildup of inventories amounts to about 12 million pounds U_3O_8. Thus the net inventory change is a drawdown of about 38 million pounds U_3O_8 over the seven-year period.

Purchase and Sale of LEU Inventories

After drawdown of their own LEU inventories to acceptable levels, utilities will have to make purchases to meet future unfilled enrichment requirements. Nuexco estimates those unfilled requirements for DOE contract holders to amount to 32 million pounds U_3O_8. Those unfilled requirements make up the balance of the 70 million pound difference between the two curves in Figure 2.

Utilities tend to buy their near-term needs on the spot market, while contracting for the longer term with primary suppliers. Over the next few years, a prominent source of enrichment services and natural uranium to meet unfilled requirements will be sellers of LEU inventory. They will compete by discounting their prices below the prices of primary suppliers in order to make spot sales.

Macroeconomic studies of this type depend for accuracy on rational economic actions by the industry participants. Unfortunately, inventory sellers are motivated not only by economics, but by political and other business factors. Thus, it is difficult to predict which inventory holders will sell, how much will be sold, and in what years. In broad terms, Nuexco expects that LEU sales by inventory holders will originate in Europe and the USA, but not in the Far East.

The market is further complicated in the period before 1987, when most USEC holders are obligated to purchase only DOE-origin SWUs. All others, including some USEC holders who terminated DOE deliveries in 1983 or earlier, can purchase non-DOE SWUs. Thus, buyers and sellers need to be matched between DOE and non-DOE origin SWUs to determine the magnitude of sales in each year.

Even so, the analysis shows there will be more inventory sellers of both DOE and non-DOE SWUs in the period before 1987 than there will be buyers of either type. Consequently, not all sellers will be able to find buyers for the delivery of material in the year desired. Advance sales will occur where deliveries are made in years subsequent to the year of sale. Due to the lack of buyers, accumulated inventories will be pushed forward in time until the market can absorb the available material offered.

Thus, inventory sales through 1987 will be controlled by buyers functioning under rational economic factors. Sales beyond 1987 are more problematical. They could be higher than estimated, since Nuexco's analysis postulated inventory selling only by the most plausible sellers. World inventory sales, by year of delivery, are estimated in Figure 4. Their cumulative total is about 55 million pounds U_3O_8 equivalent, with about one-half involving DOE-origin SWUs and one-half non-DOE SWUs.

Of the 55 million pounds U_3O_8 equivalent sold, it is expected that about 60 percent (32 million pounds equivalent U_3O_8) will be sold to DOE contract holders. The remaining 40 percent will be sold to others in Europe and other nations of the world.

Tails Assay Option

The tails assay option has a small effect on U_3O_8 feed deliveries under the USEC. Under the prior DOE contracts, one type of contract (Requirements) representing about one-half of the DOE deliveries, required a tails assay election of 0.20 w/o U_{235}. The other type of contract (Adjustable Fixed-Commitment), representing the second half of DOE deliveries, provided for a tails assay election of 0.16 to 0.30 w/o U_{235}. At current low U_3O_8 prices and high SWU prices, many utilities with the latter contract type were electing tails assays near the upper limit. The net effect was an average tails assay of about 0.25 w/o for DOE contract holders.

Under the USEC, all contract holders can elect a variable tails assay after 1986. However, for tails assay elections above 0.20 w/o, the USEC calls for a premium pay-

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Figure 4

U_3O_8 RELEASED BY LEU INVENTORY SALES
(Millions of Pounds U_3O_8)

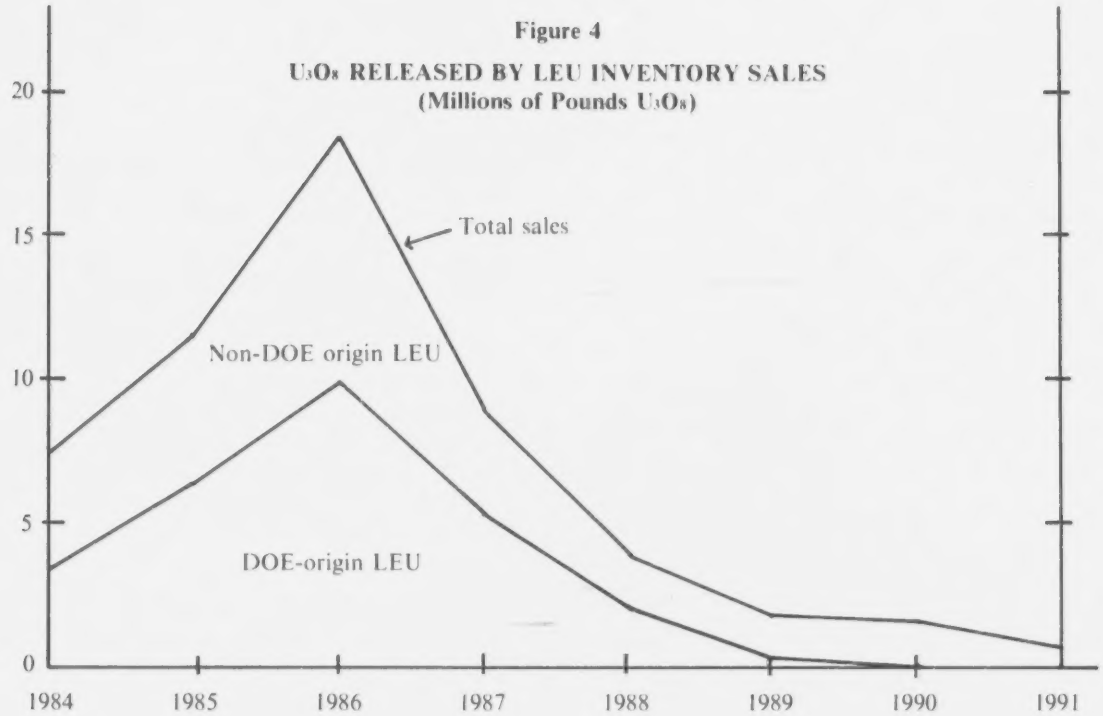
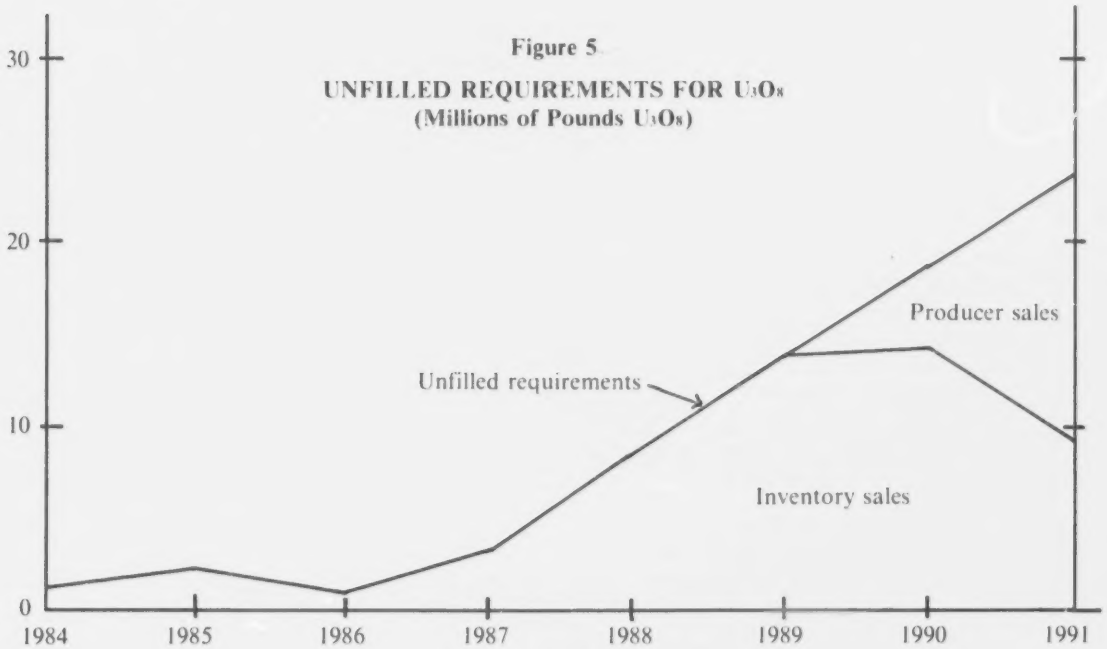


Figure 5

UNFILLED REQUIREMENTS FOR U_3O_8
(Millions of Pounds U_3O_8)



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ment. The effect of the premium is to reduce the optimum tails assay. The premium will influence all USEC holders to select a tails assay of about 0.24 w/o U_{235}. The effect of the reduction from 0.25 to 0.24 w/o U_{235} is negligible in comparison with other USEC effects.

Had the premium not been included in the USEC, the optimum tails assay, based on previous experience, would have been about 0.28 w/o U_{235}. This would have increased feed requirements by about 35 million pounds U_3O_8.

Unfilled Requirements for U_3O_8

Uranium suppliers are principally interested in U_3O_8 unfilled requirements in the WOCA nations. A forecast of unfilled requirements, allowing for inventory drawdown, is shown in Figure 5. The unfilled requirements for U_3O_8 will be satisfied either by inventory sales or by primary producer sales. World producers will have to compete with inventory sellers until those inventories are redistributed to others.

The projection of 55 million pounds U_3O_8 equivalent of expected worldwide LEU inventory sales could satisfy unfilled enrichment and U_3O_8 requirements well into the future. There is no practical way of predicting the distribution of unfilled enrichment requirements among inventory sellers and primary enrichers. Since inventory sellers generally offer lower prices to stimulate spot sales, it can be assumed that inventory sellers will gain a large share of the market in the near term.

Inventory sellers could place enough material on the spot market to satisfy most unfilled U_3O_8 requirements through 1989 (Figure 5). U_3O_8 supplier sales will take an increasing share of the unfilled requirements in 1990 and beyond. The assumptions used in Figure 5 are undoubtedly extreme, since some portion of unfilled requirements will be filled by U_3O_8 supplier sales in earlier years. These suppliers will win sales in competition with inventory sellers. As a result, inventory sales will stretch well into the 1990s. It is Nuexco's opinion that some form of secondary market will always exist to redistribute excess inventories that accrue from discrepancies in the scheduling of power plants.

Conclusions

The dynamics and disruptions of the marketplace tend to invalidate long-term quantitative forecasts. The forecasts only predict a rational market up to the time of the next major market discontinuity. With an enrichment market in turmoil, this paper draws only two conclusions. The U_3O_8 market will continue to be depressed until:

1. Sellers dispose of their large undesired LEU inventories;
2. Other holders draw down their LEU inventories to a desired level.

These actions probably will depress the U_3O_8 market for several years. It will not last as long as the results of this analysis indicate, since utilities will again anticipate the future and begin to buy U_3O_8 in advance of an expected price rise.

The benefit to the U_3O_8 suppliers comes in the longer term. The USEC will cause DOE to operate its enrichment plants during the 1980s at a level below actual customer consumption levels. With both Eurodif and DOE reducing plant loads, undesired excess inventories can be eliminated, and a new era of stability can come to the uranium supply industry.

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US AND EUROPEAN UTILITY URANIUM PURCHASES, 1979–84

Introduction

US and European utilities currently receive most of their uranium under longer-term contracts signed during the 1970s. Since 1980, longer-term contracting has been modest compared to previous years, while spot and nearer-term purchasing has increased. US utilities have diversified their sources after years of almost total reliance on US producers. In recent years, both US and European utilities have purchased large amounts of uranium from Canadian producers and from other sellers, such as utilities, traders, and national fuel companies not counted among the world's conventional producers.

These conclusions draw support from an analysis of 173 uranium purchases by US and European utilities reported by Nuexco between February 1979 (Report 126) and August 1984 (Report 192). Those transactions constitute approximately half of the uranium sales transactions reported by Nuexco during that time period (66 months), the balance being purchases by other utilities, by producers, and by companies which are not the end users of the uranium they buy. Transactions reported by Nuexco may not include all transactions closed during a referenced time period; nor does Nuexco specify the origin of the material sold.

Longer-term Contracts

Table 3 presents an analysis of the transactions reported that involved longer-term deliveries. *Longer-term* refers to multiple-year deliveries beginning or extending beyond two years from the date the transaction was reported. Table 3 sorts transactions separately for US utilities and European utilities by seller group and transaction year. (It does not indicate the years that deliveries did or will take place.) The *transaction year* extends from the February Report of one year through the January Report of the following year.

For US utilities, a noticeable statistic is the large number of transactions (11) and large associated quantity of material (24.4 million pounds) concluded in 1979 exclusively with US producers. Since 1979, the 12 reported sales from US producers have involved a total of only 15.4 million pounds, an indication of a sharp drop in demand. To satisfy unfilled requirements, US utilities have diversified their sources of longer-term supply. Eleven transactions with non-US producers and other sellers were reported between 1980 and August of this year, involving a total of 23.9 million pounds. Those figures include six contracts with Canadian producers. Deliveries under two contracts signed at the end of 1983 with an Australian producer are uncertain due to their pricing provisions.

For European utilities, two statistics stand out. One is the almost 50 million pounds contracted in 1980, principally by German utilities, for deliveries from Australia. Deliveries from the Ranger mine for some of the contracts extend for fifteen or more years. The other statistic is the nearly 30 million pounds contracted since February 1982 exclusively with Canadian producers. European utilities customarily have relied heavily on African and Australian producers for their longer-term deliveries, but in recent years no new contracts with these seller groups have been reported.

Traditionally, European utilities' contracts with their principal longer-term suppliers have specified annual price negotiations. Largely because of their reliance on overseas producers, most European utilities have endeavored to maintain mutually agreeable relations with their suppliers. By contrast, US utilities traditionally have solicited competitive bids when contracting for longer-term deliveries, and pricing formulas have been written into contracts rather than negotiated annually.

Because of regulatory fuel-adjustment clauses allowing utilities to recover the market price of fuel in the customer rate base, most US utilities have insisted on market-related pricing provisions for the past several years. Many market-related pricing provisions have used some function of a published nearer-term pricing indicator, such as the Nuexco Exchange Value, the Nukem Price Range, or the Nuexco Transaction Value, singly or in combination. Pressure on utilities from regulatory bodies to pay market prices has engendered less cooperative relations between US utilities and US producers than are found among European utilities and their suppliers; the volume of uranium-related litigation in the USA has been a testimony to that observation.

Nearer-term Purchases

Table 4 presents an analysis of transactions reported that involved nearer-term deliveries. *Nearer-term* refers to single deliveries and to deliveries within one year. Except for 1981 in Europe, when the quantity declined, the volume for material sold to US and European utilities in the nearer-term market has increased steadily since 1979. US utilities have made more individual purchases, but generally of smaller quantities. US producers' share

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ANALYSIS & COMMENTARY

Table 3

US AND EUROPEAN UTILITY URANIUM PURCHASES[1] FOR LONGER-TERM DELIVERY[2] REPORTED BY NUEXCO BETWEEN FEBRUARY 1979 AND AUGUST 1984

Seller Group	US Utilities			European Utilities		
	Thousands of Pounds U_3O_8	Percent of Total Quantity	Number of Trans-actions	Thousands of Pounds U_3O_8	Percent of Total Quantity	Number of Trans-actions
1979 Transaction Year[3]						
African producer	0	0	0	3,300	71	2
Australian producer	0	0	0	0	0	0
Canadian producer	0	0	0	400	9	1
US producer	24,445	100	11	900	20	2
Other seller[4]	0	0	0	0	0	0
	24,445	100	11	4,600	100	5
1980 Transaction Year						
African producer	0	0	0	12,780	21	3
Australian producer	500	12	1	48,840	79	6
Canadian producer	0	0	0	0	0	0
US producer	3,330	79	2	300	0	1
Other seller	366	9	1	0	0	0
	4,196	100	4	61,920	100	10
1981 Transaction Year						
African producer	0	0	0	0	0	0
Australian producer	0	0	0	5,200	69	1
Canadian producer	2,750	89	1	2,340	31	1
US producer	330	11	1	0	0	0
Other seller	0	0	0	0	0	0
	3,080	100	2	7,540	100	2
1982 Transaction Year						
African producer	0	0	0	0	0	0
Australian producer	0	0	0	0	0	0
Canadian producer	5,100	57	4	10,280	100	3
US producer	3,875	43	4	0	0	0
Other seller	0	0	0	0	0	0
	8,975	100	8	10,280	100	3
1983 Transaction Year						
African producer	0	0	0	0	0	0
Australian producer[5]	5,400	91	2	0	0	0
Canadian producer	0	0	0	9,702	100	1
US producer	500	9	1	0	0	0
Other seller	0	0	0	0	0	0
	5,900	100	3	9,702	100	1
1984 Transaction Year (first seven months)						
African producer	0	0	0	0	0	0
Australian producer	0	0	0	0	0	0
Canadian producer	1,500	11	1	6,660	100	2
US producer	7,350	56	4	0	0	0
Other seller	4,310	33	2	0	0	0
	13,160	100	7	6,660	100	2

[1]Includes purchases by utility fuel procurement departments only. Excludes purchases by national companies which may sell uranium to utilities.
[2]Refers to multiple-year deliveries beginning or extending beyond two years from the date the transaction was reported.
[3]Transaction year includes transactions listed in the February Report of the referenced year through the January Report of the following year.
[4]Other sellers include utilities, fuel procurement organizations independent of utilities, trading companies, and other organizations not defined as producers. The material they sell may be of any origin.
[5]Deliveries under these contracts are highly uncertain due to floor-price provisions.

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Table 4
US AND EUROPEAN UTILITY URANIUM PURCHASES[1]
FOR NEARER-TERM DELIVERY[2]
REPORTED BY NUEXCO BETWEEN FEBRUARY 1979 AND AUGUST 1984

Seller Group	US Utilities			European Utilities		
	Thousands of Pounds U_3O_8	Percent of Total Quantity	Number of Trans-actions	Thousands of Pounds U_3O_8	Percent of Total Quantity	Number of Trans-actions
1979 Transaction Year[3]						
African producer	0	0	0	260	23	1
Australian producer	0	0	0	0	0	0
Canadian producer	0	0	0	0	0	0
US producer	1,544	93	9	300	27	1
Other seller[4]	110	7	2	554	50	3
	1,654	100	11	1,114	100	5
1980 Transaction Year						
African producer	0	0	0	0	0	0
Australian producer	0	0	0	0	0	0
Canadian producer	0	0	0	500	24	2
US producer	1,299	85	9	840	40	4
Other seller	236	15	2	770	36	4
	1,535	100	11	2,110	100	10
1981 Transaction Year						
African producer	0	0	0	0	0	0
Australian producer	0	0	0	0	0	0
Canadian producer	400	15	1	200	22	1
US producer	1,291	49	8	302	33	2
Other seller	950	36	2	415	45	1
	2,641	100	11	917	100	4
1982 Transaction Year						
African producer	0	0	0	0	0	0
Australian producer	0	0	0	0	0	0
Canadian producer	150	7	1	0	0	0
US producer	440	21	4	0	0	0
Other seller	1,538	72	8	2,100	100	4
	2,128	100	13	2,100	100	4
1983 Transaction Year						
African producer	0	0	0	0	0	0
Australian producer	0	0	0	0	0	0
Canadian producer	710	20	2	200	5	1
US producer	1,325	37	9	0	0	0
Other seller	1,557	43	5	3,747	95	8
	3,592	100	16	3,947	100	9
1984 Transaction Year (first seven months)						
African producer	0	0	0	0	0	0
Australian producer	0	0	0	0	0	0
Canadian producer	1,350	28	3	1,034	28	2
US producer	622	13	4	474	13	2
Other seller	2,833	59	5	2,134	59	5
	4,805	100	12	3,642	100	9

[1]Includes purchases by utility fuel procurement departments only. Excludes purchases by national companies which may sell uranium to utilities.
[2]Refers to deliveries within one year, and in some cases deliveries within two years if pricing terms are known.
[3]Transaction year includes transactions listed in the February Report of the referenced year through the January Report of the following year.
[4]Other sellers include utilities, fuel procurement organizations independent of utilities, trading companies, and other organizations not defined as producers. The material they sell may be of any origin.

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of the market has declined, while that of other sellers and Canadian producers has increased.

No sales by Australian producers have been reported during the last six years, mainly because the government-imposed floor price has exceeded the market price for most of the referenced period. African producers generally have not sold in the nearer-term market primarily because prices have been so low, and the producers have been reluctant to set a precedent that might be used to their detriment in annual price negotiations under their longer-term contracts.

In recent years, non-producer inventory sellers (other sellers) have gained the majority share of the nearer-term market in both the USA and Europe. Much of the natural uranium that has been sold by other sellers has been liberated by deenrichment swaps and SWU assignments in the secondary market for enrichment services. In a few notable cases, US utilities have liquidated their uranium holdings at bargain prices following the cancellation of their nuclear power units.

During the past year, non-US inventory holders have been willing to sell material at low dollar prices in large part because of the strength of the US dollar against other currencies. Favorable exchange rates have also drawn some non-US producers into the nearer-term market. However, in the case of some Canadian producers that have become active in both the longer-term market and the nearer-term market, the increase in activity can best be attributed to the high grade of the deposits they mine.

Conclusion

The uranium purchasing practices of US and European utilities during the early 1980s changed in accordance with three basic trends.

1. The amount of unfilled requirements dropped steadily due to coverage under existing longer-term contracts, as well as to sharp reductions in planned nuclear generating capacity.

2. Canadian producers received most of the recent longer-term business in Europe, and a large amount in the USA. Producers in Western Canada owning large, high-grade deposits, have offered low prices for their uranium.

3. Non-producer inventory holders liquidated much of their unneeded stocks in the nearer-term market. Plant delays and cancellations created many of the excessive inventories, while an active secondary market for enrichment services liberated much of the natural uranium. A strong US dollar has created currency exchange rates favorable to non-US sellers, and has had a deflationary effect on uranium prices.

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JAPAN

Report 191 (July 1984) outlined an FEPC (Federation of Electric Power Companies) plan for siting commercial enrichment, reprocessing, and low-level waste facilities. The plan recommended location of all facilities at one or two sites on the Shimokita Peninsula at the extreme north end of Japan's main island of Honshu.

Subsequent discussion by FEPC representatives with local officials and citizens' groups of Aomori Prefecture has resulted in the selection of a single site for the entire complex. The site covers 6.5 square kilometers near the municipality of Rokkasho-Mura, in the Mutsu-Ogawara industrial development area on the Pacific side of Aomori Prefecture.

The FEPC has modified and formalized some of the details surrounding the complex, including facility capacities and scheduled operation dates.

1. *Enrichment:* A new company will be formed by the utilities to own and operate a plant capable of producing 150,000 SWUs per year by 1991, and 1.5 million SWUs by 1997. The FEPC estimates that the plant will require an investment equivalent to approximately $600 million. Power Reactor and Nuclear Fuel Development Corporation (PNC) has developed centrifuge technology for use at the plant (see Report 189). Facilities will be expanded incrementally.

2. *Reprocessing:* The Japanese utilities organized Japan Nuclear Fuel Services (JNFS) in 1980 to oversee the construction and operation of the commercial-scale reprocessing plant. The plant will consist of a 3,000-ton spent fuel storage facility, to be in operation in 1991, adjacent to a reprocessing facility having the capacity to process 800 tons of spent fuel per year by 1995. The 800-ton capacity target is a reduction from the previous proposal of 1,000 tons per year by the early 1990s. Technology will be adopted from PNC's 210-ton per year demonstration plant at Tokai-Mura. The estimated cost of the reprocessing plant will be close to $3 billion.

3. *Low-level Waste Storage:* The FEPC will form a new company to handle the transport and storage of low-level waste generated by the country's LWRs. At the present time no central storage facility exists in Japan; each plant has its own on-site waste-storage facility. By 1991 the national facility will have the capacity to store approximately 1 million 55-gallon drums. The utilities visualize subsequent expansion to contain the equivalent of 3 million drums. The expected cost of the facility is approximately $400 million.

The FEPC has initiated negotiations on a local level to acquire the approvals necessary for construction of the planned complex, and hopes to begin site preparation within one to two years. Because the site is located in an area designated by the national government for industrial development, much of the non-nuclear review process has been completed. Under favorable licensing conditions, the planned commercial operation dates may be achieved.

In a related development, the three manufacturers that supply centrifuges to PNC for its enrichment program announced plans to form a joint venture to provide machines to the new enrichment company. Toshiba, Hitachi, and Mitsubishi Heavy Industries (MHI) are scheduled to organize a company later this year. The company would be located in Sendai, the largest metropolitan area near the Rokkasho site. In August, the three conglomerates opened a joint office for initial organizational work.

SOUTH AFRICA

NUCOR (the Nuclear Development Corporation of South Africa [Pty] Ltd.) recently released an updated official assessment of South Africa's uranium resources and production capabilities. Although the release of such information is closely controlled in South Africa under the National Energy Act, the report contains some of the most comprehensive information published on the subject. Included are the latest official assessments of trends in uranium prospecting, production and prices, as well as discussions of geology and national policy matters.

NUCOR periodically reassesses South Africa's uranium resource and production capabilities. It expresses the total recoverable resources and their associated costs in terms of Reasonably Assured Resources (RAR) and Estimated Additional Resources (EAR). RAR refers to uranium that occurs in deposits known to facilitate recovery within given production cost ranges using current technology. Category I of EAR refers to uranium that is expected to occur in extensions of known deposits, but where specific data to classify the resource as RAR is inadequate.

Table 5 summarizes the NUCOR findings during 1983. NUCOR estimated that the total RAR and EAR recoverable for less than $130 per kgU ($50 per pound U_3O_8) amounted to 460,000 MTU (1.196 billion pounds U_3O_8). That figure represents a 13.4 percent decline compared to the 1981 assessment. South Africa produced 6,060 MTU (15.75 million pounds U_3O_8) in 1983, surpassing 1981 production by 244 tons, or 4.2 percent.

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RECENT DEVELOPMENTS

South Africa reinforced its position as a leader in uranium production by supplying 14 percent of the free world's uranium in 1983. By current estimates, the country also holds 14 percent of the free world's uranium resources, so its supply position appears secure. The Witwatersrand quartz-pebble conglomerates are the basis of 97 percent of South Africa's production; the Palabora project produces the remaining 3 percent as a by-product of copper mining. Exploration in the Witwatersrand and the discovery of potentially viable deposits in the Karoo Sequence have rendered uncertain the forecasts of long-term uranium production in South Africa. However, it is clear that the country will continue to be a major world producer well into the next century.

Table 5

SOUTH AFRICA'S URANIUM RESOURCES IN THE RAR AND EAR-I CATEGORIES[1] AS OF JANUARY 1, 1983, AND JANUARY 1, 1981[2]
(Expressed in metric tons U)

Principal Deposits or Districts	Reasonably Assured Resources (RAR)[3]		Estimated Additional Resources (EAR)[4]		Percent of Total
	$0–$80/kgU	$80–$130/kgU	$0–$80/kgU	$80–$130/kgU	
Witwatersrand Basin Conglomerates	163,000 (206,000)	50,000 (55,000)	98,000 (81,000)	43,000 (80,000)	77 (79)
Witwatersrand Basin Tailings	22,000 (35,000)	21,000 (9,000)	— (2,000)	— (5,000)	9 (9)
Palabora	2,000 (3,000)	— —	— —	— —	1 (1)
Karoo Sequence	4,000 (3,000)	50,000 (44,000)	1,000 (1,000)	5,000 (6,000)	12 (10)
Younger Surficial Sediments	— —	1,000 (1,000)	— —	— —	1 (1)
TOTAL RESOURCES	191,000 (247,000)	122,000 (109,000)	99,000 (84,000)	48,000 (91,000)	100 (100)

[1]Exploitable at costs of less than $130/kgU.
[2]Estimates as of January 1, 1981 are shown in parentheses.
[3]Reasonably Assured Resources (RAR) refers to uranium that occurs in known mineral deposits of such size, grade and configuration that it could be recovered within the given production cost ranges with currently proven mining and processing technology. Estimates of tonnage and grade are based on specific sample data and measurements of the deposits and on knowledge of deposit characteristics. Reasonably Assured Resources have a high assurance of existence and in the cost category below $80/KgU are considered as *reserves* for the purposes of this table.
[4]Estimated Additional Resources category I (EAR-I) refers to uranium in addition to RAR that is expected to occur, mostly on the basis of direct geological evidence in extensions of well-explored deposits and in deposits in which geological continuity has been established but where specific data and measurements of the deposits and knowledge of the deposits' characteristics are considered to be inadequate to classify the resource as RAR. Such deposits can be delineated and the uranium subsequently recovered, all within the given cost ranges. Estimates of tonnage and grade are based on such sampling as is available and on knowledge of the deposit characteristics as determined in the best-known parts of the deposit or in similar deposits. Less reliance can be placed on the estimates in this category than on those for RAR.

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UNITED KINGDOM

The Central Electricity Generating Board (CEGB) has begun commercial operation of three AGRs (Advanced Gas-cooled Reactors) thus far in 1984, and by year-end three more units are scheduled to achieve that status (Table 6). Thus, 1984 is a milestone year in the implementation of the UK's long-delayed commercial AGR program. Construction is proceeding rapidly on two other AGRs, Heysham Units B1 and B2; CEGB expects to begin commercial operation of those in 1987 and 1988. The South of Scotland Electricity Board (SSEB) is building two AGRs at Torness Point in northern Scotland; construction there is proceeding smoothly also.

Nuclear power's contribution to CEGB's electricity generation has doubled since last year, partly because of the completion of the new units, but mostly because of the six-month-old national coal strike. The coal strike has forced CEGB also to increase the use of oil, which has had the effect of raising the utility's operating costs substantially.

In recent months, the Sizewell inquiry, which began twenty months ago, has focused on the merits of the PWR design compared to the AGR. Recent progress with the AGR may actually be hurting CEGB's case for Sizewell. The Sizewell B PWR plan arose largely in response to the limitations and bad luck of the AGR program during the 1970s. As CEGB, SSEB, and the associated industrial groups have gained experience and the AGR program has matured, questions have arisen about the wisdom of abandoning the design, which was developed in the UK. However, because CEGB has invested heavily in the PWR's future, it is unlikely the utility will reverse its design decision.

Table 6

ADVANCED GAS-COOLED REACTORS IN THE UK

Unit	Net MWe	Utility	Percent Complete	COD[1]
Hinkley Point B1	625	CEGB[2]	100	Jun 1976
Hinkley Point B2	625	CEGB	100	Jan 1977
Hunterston B1	625	SSEB[3]	100	Jun 1976
Hunterston B2	625	SSEB	100	May 1977
Dungeness B1	600	CEGB	100	Mar 1984
Heysham A1	625	CEGB	100	May 1984
Hartlepool A1	625	CEGB	100	May 1984
Heysham A2	625	CEGB	100	1984
Hartlepool A2	625	CEGB	100	1984
Dungeness B2	600	CEGB	100	1984
Heysham B1	660	CEGB	60	1987
Heysham B2	660	CEGB	45	1988
Torness Point 1	660	SSEB	50	1987
Torness Point 2	660	SSEB	34	1988

[1]COD = Commercial Operation Date, based on published information and utility forecasts.
[2]CEGB = Central Electricity Generating Board.
[3]SSEB = South of Scotland Electricity Board.

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RECENT DEVELOPMENTS

UNITED STATES

Introduction

Four nuclear power units have begun commercial operation in the USA in the past eight months, adding 4,258 MWe to US nuclear generating capacity and increasing the US total by approximately three percent. Another four utilities earned full power operating licenses, and two of them are planning to bring their reactors to commercial operation before the end of the year (Table 7). If the utilities succeed in their plans, twice as many units will have begun commercial generation this year as in 1983. While such a development might encourage an optimistic outlook for the future of nuclear power in the USA, utilities unfortunately will end the year facing the same financial, institutional, and societal obstacles that have plagued the industry for years. Moreover, utilities still must face reduced projections of electricity demand, which have contributed heavily to the numerous delays and cancellations of nuclear plants.

Commercial Operations

Southern California Edison's San Onofre Unit 3 on April 1, 1984 became the latest reactor to begin commercial operation. South Carolina Electric and Gas Company's Summer Unit 1 and Duke Power's McGuire Unit 2 began commercial operations in January and March, respectively. Commonwealth Edison added its La Salle Unit 2 to the rate base in August, after receiving a full power license in April 1984; the unit probably will enter commercial operation by the end of this year.

Diablo Canyon

Years of litigation and plant modifications at Pacific Gas & Electric's (PG&E) Diablo Canyon Unit 1 culminated in August with an NRC decision to grant the utility a full power operating license. PG&E received a construction permit for Diablo Canyon Unit 1 in April 1968, and PG&E's application for an operating license had been

Table 7

1984 NUCLEAR POWER LICENSING PROGRAMS IN THE USA

Unit	Utility	Date	Type	MWe net
Commercial Operation				
Summer 1	South Carolina Electric & Gas	Jan 1984	PWR	900
McGuire 2	Duke Power	Mar 1984	PWR	1180
San Onofre 3	Southern California Edison	Apr 1984	PWR	1100
La Salle 2	Commonwealth Edison	Aug 1984	BWR	1078
Full Power Operating Licenses				
WNP 2	Washington Public Power	Apr 1984	BWR	1100
Susquehanna 2	Pennsylvania Power and Light	Apr 1984	BWR	1050
Grand Gulf 1	Mississippi Power and Light	Jul 1984	BWR	1250
Diablo Canyon 1[1]	Pacific Gas & Electric	Aug 1984	PWR	1084
Fuel Loading and Low Power Testing Licenses				
Callaway 1	Union Electric	Jun 1984	PWR	1150
Catawba 1[2]	Duke Power	Jul 1984	PWR	1145
TOTAL MWe				10,137

[1]The full power license for Diablo Canyon 1 has been rendered ineffective by a federal appeals court's injunction designed to block full power operation. The case is awaiting further federal hearings.
[2]The NRC authorized fuel loading and pre-critical testing for Duke Power's Catawba Unit 1, but it has not yet granted the utility a low power license.

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pending since 1973, making it the NRC's longest-running case. The utility received a low power operating license in September 1981, but the NRC suspended the license in November 1981 due to lack of adequate seismic safety assurances. The full power license was granted on August 2, 1984, and PG&E was prepared to initiate full power testing following the activation of the order by the NRC legal department. When PG&E received the license, opponents of the project quickly renewed objections based on the plant's proximity to an earthquake fault, and a federal appeals court issued an injunction that temporarily blocked power testing. Supreme Court Justice Warren Burger upheld the injunction, possibly so the entire Supreme Court could review the case, by refusing to hear a PG&E appeal. The current review of the case by federal appeals courts may delay full power testing for an indefinite period.

An NRC licensing decision for low power testing regarding Diablo Canyon Unit 2 depends on the outcome of an independent design verification program now taking place. The unit is 97-percent complete, and PG&E plans to begin commercial operation in June 1985.

Full Power Operating Licenses

Several other units reached full power operation in the first half of 1984. Following numerous management changes at Mississippi Power and Light, the NRC granted the utility a full power license for its Grand Gulf Unit 1 in August, and the utility has begun power ascension. In reviewing the case, the NRC noted the plant's history of design problems and technical specification errors, and commended the utility's efforts to alleviate those problems. The utility does not expect commercial operation for another seven months. Mississippi Power and Light plans to resume construction on Grand Gulf Unit 2, which is 30-percent complete, after Unit 1 begins commercial operation.

In May, Pennsylvania Power and Light (PP&L) received a full power license for its Susquehanna Unit 2. The utility plans to begin commercial operation at the end of this year. PP&L purchased the initial fuel core for Cincinnati Gas & Electric Company's Zimmer plant for reload use in Susquehanna Unit 2. The unused core, which had been on the Zimmer site since 1979, required refabrication because the Zimmer fuel was not as highly enriched as the fuel used by the Susquehanna unit. Once refabricated, the core should provide about one-third of the material for five to six reloads.

Fuel Loading and Low Power Testing

One utility received approval for fuel loading in 1984, and one received authorization for low power testing. The NRC approved pre-criticality testing for Duke Power Company's Catawba Unit 1 in July 1984, and the utility is expected to seek NRC approval for full power operations near the end of 1984. Still to be resolved before the unit can be licensed are some quality assurance and welding problems related to the plant's safety systems. However, those issues probably will not delay the scheduling of full power license requests.

Fuel loading began at Union Electric Company's Callaway Unit 1 in June, and the low power license granted by the NRC allowed the unit to begin 5-percent power operation. Union Electric was about six months ahead of the NRC's projected schedule for receiving the low power license, and the utility is anticipating a request for a full power license by September 1984. Union Electric has submitted a rate increase request to the Missouri Public Service Commission to help defray the cost of the Callaway plant. It is seeking either a single 65-percent ($639 million) rate increase, or a $708 million increase spread over a five-year period, with a 25-percent increase the first year and 8-percent increases over each of the four succeeding years. The utility estimates that the construction of the Callaway plant is responsible for 85 percent of the proposed rate hike.

Setbacks

Several utilities canceled plans for new units in the first eight months of 1984. The most recent was the TVA (Tennessee Valley Authority) cancellation of four of its units on August 29, 1984. This action had been expected since the utility decided to mothball Hartsville Units A-1 and A-2 and Yellow Creek Units 1 and 2 in 1982. The TVA action had no effect on Nuexco forecasts of uranium consumption, because the forecasts have for several years anticipated the cancellations. TVA estimated that $5 billion would be required to finish the Hartsville plant, which is 44-percent and 34-percent complete. The Yellow Creek plant, which is 35-percent and 3-percent complete, would require another $9.6 billion. TVA hopes to sell plant hardware that has already been purchased.

Consumers Power Company "shut down" its two-unit Midland plant on July 16. The utility has filed to recover the $3.6 billion in construction costs and $400 million in fuel costs invested as of August, and has turned to the Michigan Public Service Commission for financial relief. Consumers Power is threatening to file for bankruptcy

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unless enough sunk costs are recovered. The units, both about 85-percent complete, originally were scheduled for completion in 1978 and 1979. The utility is considering mothballing the plant in the hopes that its completion someday will become economically feasible. However, the costs of mothballing, estimated to be about $85 million, plus annual maintenance costs exceeding $15 million, may be prohibitive.

Consumers Power also must decide what to do with the two fabricated initial fuel cores purchased for the Midland units. The cores reportedly contain a total of 164,000 kgU in enriched UF_6. While Consumers could refabricate the material for use in one of the other units, it may consider offering the cores for sale. However, it is likely that the utility will hold on to the cores for the remainder of the year.

Public Service of Indiana effectively canceled its Marble Hill Units 1 and 2 in January 1984 when it withdrew financial support for the plant. Shortly thereafter, Cincinnati Gas and Electric announced the cancellation of its Zimmer nuclear plant. The Zimmer plant may be converted to a coal-fired station, although the cost of such a conversion would approach the cost of finishing the nuclear plant. (These developments were reported in Report 188, in an article summarizing the US nuclear plant backlog for 1984).

Conclusion

While projected commercial operation dates seem to indicate an upward trend in the industry, it is too early to draw optimistic conclusions for 1984. It is possible that there will be a substantial increase in the number of commercially operating units compared to 1983. Several projects have made extraordinarily good progress of late, such as Union Electric's Callaway Unit 1, which is six months ahead of schedule. Conversely, plants with long histories of licensing or management problems, such as Diablo Canyon Unit 1, continue to encounter public resistance. Among other problems, the financial burden associated with the construction of a nuclear plant still severely restricts utilities. When a plant such as Midland is canceled after reaching 85-percent completion, utilities understandably are discouraged from taking risks associated with building new units. In fact, it is virtually certain that no new orders for nuclear power units will be placed in the USA in this decade, and perhaps not in this century.

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KOREA

Nuclear Power Program

Twenty years of rapid growth in the Korean economy led to an ambitious nuclear power plan in the mid-1970s for 30,000 MWe of nuclear generating capacity by 1990. Slower economic growth in recent years has led Korea Electric Power Company (Kepco) to reduce that target to 7,165 MWe. Three units are currently operating commercially; they generated approximately 5.7 million megawatt-hours (MWh) of electricity in the first half of 1984. Two of the three operating units are Westinghouse PWRs located at the Ko-Ri site near Pusan; the third operating unit is a 629-MWe Candu that was built and tested in under six years. Six units are currently under construction (Table 8), while construction generally has proceeded briskly. Kepco has had some technical and contractual problems with the two Framatome units at Ul-Jin.

Kepco is responsible for all generation and distribution of electricity in South Korea. Its nuclear power development program is outlined in the government's five-year plans. Kepco rescheduled the nuclear program most recently in November 1983, postponing plans for new units and delaying the completion dates of the six units under construction. Three factors explain the cutbacks in the utility's plans:

1. The slowdown of economic growth in recent years and the consequent decline in electricity demand growth;
2. The drop in oil prices, which has made less urgent the need to cut dependence on oil (55 percent of generating capacity in 1981);
3. The government's desire to reduce the foreign debt ($40.2 billion as of January 1984).

Other Developments

While the nuclear power program in general has slowed, South Korea is proceeding with other developments. The country seeks to increase the degree of autonomy and self-sufficiency in its nuclear program. All three operating units were built on a turnkey basis, but the newer units have involved a degree of Korean participation. The Korea Power Engineering Corporation (Kopec), an engineering subsidiary of Kepco, is promoting the development of local architect-engineering capability through joint ventures and agreements with overseas companies. The firm is aiming for 21 percent of the architect-engineering work on Ko-Ri Units 5 and 6.

Kepco also manages and partially owns Korea Heavy Industries and Construction (KHIC), and is helping KHIC to localize the construction of all major hardware components by the end of the 1980s. KHIC is involved in most of the work on the Framatome units now under construction, and, as the sole designated Korean manufacturer, it is the umbrella licensee to the main supplier companies abroad. KHIC hopes to award subcontracts in the future to smaller Korean companies.

South Korea also plans to build a fuel fabrication plant, to be operational by 1990, sufficient for Kepco's planned program. Fifty-one percent of the 200 MTU per year plant will be controlled by Kepco and the Korea Advanced Energy Research Institute (KAERI), a department within the Ministry of Science and Technology. Foreign interests will control the remaining 49 percent.

Table 8

NUCLEAR POWER UNITS IN SOUTH KOREA

Unit	Plant	MWe	Type	COD[1]	Percent Complete
KNU 1	(Ko-Ri)	556	PWR	4/78	100
KNU 3	(Wolsung)	629	Candu	4/83	100
KNU 2	(Ko-Ri)	605	PWR	7/83	100
KNU 5	(Ko-Ri)	895	PWR	3/85	90
KNU 6	(Ko-Ri)	895	PWR	12/85	80
KNU 7	(Yeonggwang)	900	PWR	3/86	60
KNU 8	(Yeonggwang)	895	PWR	3/87	50
KNU 9	(Ul-Jin)	895	PWR	3/88	25
KNU 10	(Ul-Jin)	895	PWR	3/89	20

[1]Actual or expected Commercial Operation Date.

Fuel Sources

South Korea (population 40 million) relies heavily on uranium imports, although it has approximately 43.6 million tonnes of black shale uranium resources with an average grade of 0.04 percent. The Korea Institute of Energy and Resources has developed the technology for recovery of the uranium. In addition, KAERI is building a pilot plant capable of processing three tonnes of ore per day. Canadian and Australian producers each supply approximately 40 percent of South Korea's natural uranium requirements; Cogema provides the balance, which will be used for the two Framatome units at Ul-Jin (Figure 6).

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Figure 6

NUCLEAR POWER UNITS IN SOUTH KOREA

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Kepco has also acquired interests in mining ventures abroad. It owns 4.5 percent of the Dawn Lake project in Canada, development of which may begin in the 1990s. It also established a joint venture with Taiwan Power Company and the Anschutz Corporation of the USA to explore for uranium in Paraguay, but the effort was recently terminated. Kepco is exploring for uranium in Gabon in cooperation with Cogema and the government of Gabon.

Kepco's enrichment needs are covered by Adjustable Fixed-Commitment contracts with DOE, except for the two Framatome units, which are covered by Cogema. Kepco has expressed interest in converting to the Utility Services enrichment contract (USEC).

TAIWAN

Nuclear Power Program

Taiwan's five commercially operating nuclear power units generated approximately 10.1 million megawatt-hours (MWh) in the first half of 1984. Two of the units, Chin-Shan 2 and Kuosheng 1, have operated above 80-percent capacity factors this year. The 907-MWe Maanshan Unit 1 began commercial generation on July 27, 1984. Maanshan Unit 2 is 90-percent complete and is scheduled to begin commercial operation in May 1985 (Table 9).

Table 9

NUCLEAR POWER UNITS IN TAIWAN

Unit	MWe	Type	COD[1]	Percent Complete
Chin-Shan 1	604	BWR	Dec 1978	100
Chin-Shan 2	604	BWR	Sep 1979	100
Kuosheng 1	951	BWR	Dec 1981	100
Kuosheng 2	951	BWR	Mar 1983	100
Maanshan 1	907	PWR	Jul 1984	100
Maanshan 2	907	PWR	May 1985	90

[1]Actual or expected Commercial Operation Date.

There are three existing plant sites in Taiwan (Figure 7), each of which can accommodate more units. Recently, however, Taipower (Taiwan Power Company) revived plans to build two units at a new plant site, Yenliao. The state utility has budgeted $4.3 billion for the new plant, which it hopes to have in operation in the early 1990s. A 10.9-percent increase in electricity consumption last year, coupled with an expected 1984 real economic growth rate of 8 percent, induced Taipower to revive the seventh and eighth units. The utility is likely to invite bids in the near future from General Electric, Westinghouse, Combustion Engineering, Framatome and Kraftwerk Union; Taipower itself probably will serve as constructor.

Unlike the situation in Korea and Japan, the desire to develop complete domestic nuclear engineering capability has not been pronounced in Taiwan. All of the operating reactors and most of the nuclear technology have come from the USA. However, Taipower has a strong construction division and generally works closely with US architect-engineering firms, notably Ebasco and Bechtel. All of the civil engineering responsibilities are handled by local companies.

Fuel Supplies

Taipower currently has an inventory of uranium amounting to several years' forward consumption. African producers provide over 70 percent of needs through 1989, while Australian and US producers supply the remainder. Conversion is handled in the USA by Allied. Geologists recently made the first indigenous discovery of uranium in Taiwan at Sanhsia, 20 kilometers south of Taipei, following almost a year of exploration. Drill holes indicated ore grade of 0.36 percent.

Enrichment services for all six existing units are contracted to DOE under AFCs, and it is likely the utility will convert soon to the USEC. Taipower has purchased some SWUs by assignment from US utilities.

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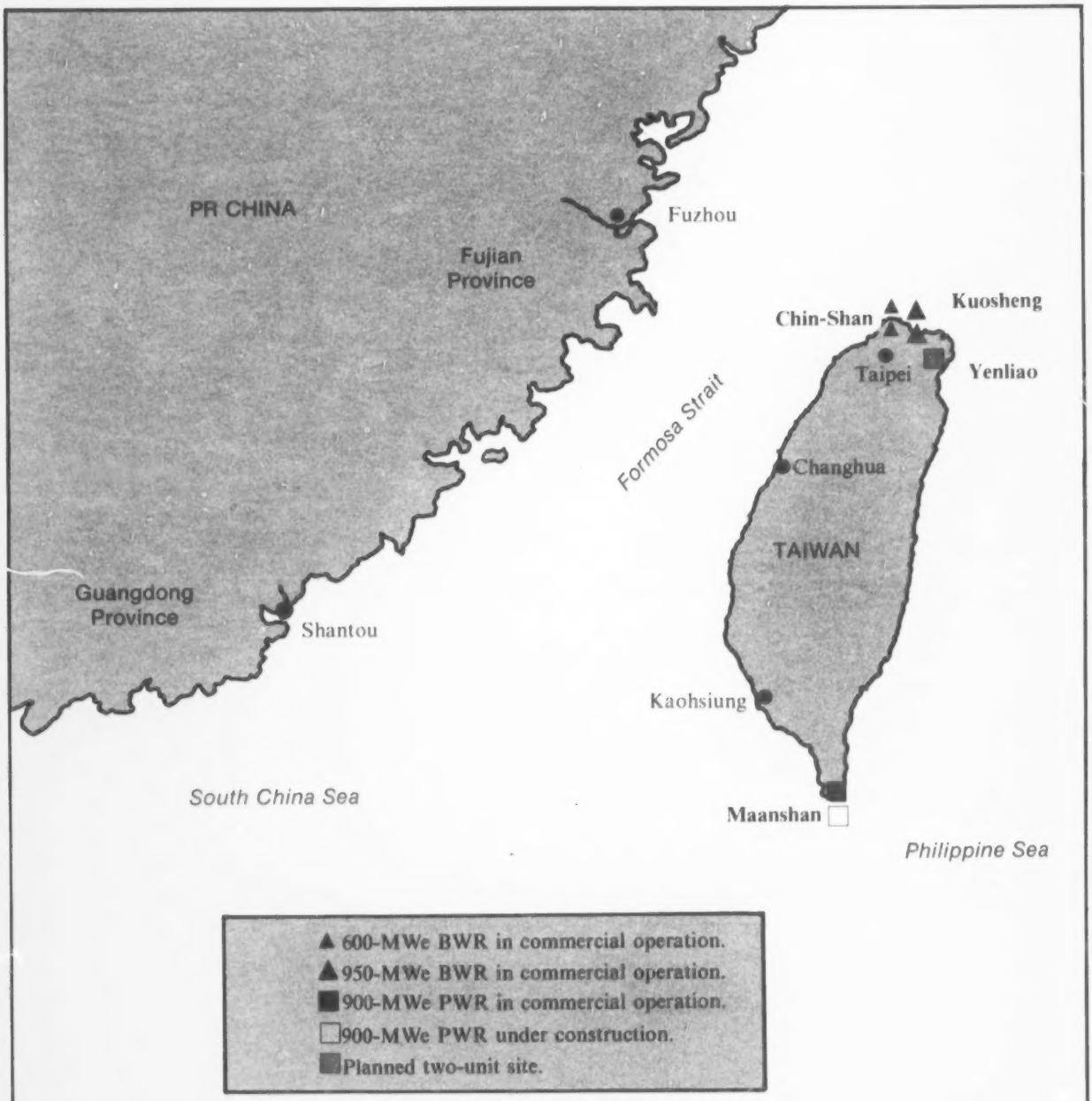

Figure 7

NUCLEAR POWER UNITS IN TAIWAN

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EXCHANGE AND TRANSACTION VALUES SINCE JANUARY 1979

Determined as of the last day of the month indicated

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HISTORICAL MARKET DATA

HISTORICAL EXCHANGE VALUES

Determined as of the last day of the month indicated (US Dollars/lb. U_3O_8)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1968	—	—	—	—	—	—	—	6.35	6.35	6.40	6.45	6.50
1969	—	6.35	6.10	6.10	6.25	6.25	6.20	6.20	6.15	6.15	6.15	6.20
1970	6.30	6.30	6.30	6.30	6.30	6.30	6.30	6.20	6.15	6.15	6.15	6.15
1971	6.20	6.20	6.20	6.20	6.15	6.05	6.00	5.95	5.95	5.95	5.95	5.95
1972	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95
1973	5.95	6.00	6.10	6.20	6.45	6.50	6.50	6.50	6.50	6.50	6.75	7.00
1974	7.70	7.90	8.00	9.00	9.50	10.50	11.50	12.00	12.50	14.00	14.75	15.00
1975	16.00	16.00	18.00	20.00	21.00	23.00	24.70	26.00	26.00	28.50	30.00	35.00
1976	32.50	37.00	39.25	40.00	40.00	40.00	40.00	40.40	41.00	41.00	41.50	41.00
1977	41.35	41.50	41.60	41.60	42.00	42.25	42.25	42.25	42.40	42.75	43.20	43.20
1978	42.90	43.25	43.25	43.25	43.40	43.40	43.40	43.10	43.25	43.00	43.25	43.25
1979	43.25	43.25	43.25	43.25	43.25	43.00	42.70	42.70	42.20	42.20	41.00	40.75
1980	40.00	38.00	35.00	32.00	32.00	31.50	31.50	30.00	28.50	28.00	28.00	27.00
1981	25.00	25.00	25.00	25.00	25.00	24.25	23.50	23.50	23.50	23.50	23.50	23.50
1982	23.00	23.00	22.50	20.75	20.50	19.25	18.25	17.00	17.00	17.50	19.75	20.25
1983	21.50	21.75	22.25	23.25	23.50	23.50	24.00	24.00	24.00	23.50	22.50	22.00
1984	20.50	17.50	17.00	17.75	17.75	17.50	17.50	**17.50**				

HISTORICAL TRANSACTION VALUES

Determined as of the last day of the month indicated (US Dollars/lb. U_3O_8)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1976	—	—	—	—	39.60	39.70	39.70	40.40	40.30	40.60	40.70	40.70
1977	41.30	41.30	41.40	41.50	42.80	42.90	43.00	42.60	42.50	42.80	42.90	42.90
1978	43.10	43.30	43.70	43.60	43.60	43.20	43.30	43.40	43.40	43.60	43.40	43.70
1979	43.60	43.80	43.70	43.40	43.60	43.70	43.70	43.60	43.60	43.60	43.50	42.30
1980	42.00	39.30	38.60	38.40	37.90	37.60	37.30	31.60	30.60	29.00	28.70	27.70
1981	27.20	27.20	27.00	25.70	25.70	24.50	24.40	24.30	23.90	24.10	24.10	24.00
1982	24.00	23.70	23.40	22.60	22.70	21.50	20.30	19.10	17.30	17.00	17.55	18.80
1983	19.35	20.00	21.35	21.40	22.35	22.45	23.50	23.60	23.65	23.65	23.85	23.85
1984	23.05	22.50	19.25	17.90	17.00	16.50	16.60	**16.40**				

HISTORICAL CONVERSION VALUES

Determined as of the last day of the month indicated (US Dollars/lb. U as UF_6)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1981	1.20	1.20	1.20	1.40	1.15	1.15	1.15	1.10	1.10	1.10	1.20	1.20
1982	1.20	1.20	1.20	1.20	1.00	1.00	1.00	0.90	1.10	1.60	1.45	1.45
1983	1.20	1.40	1.40	1.20	1.20	1.20	1.10	1.10	1.00	0.60	0.60	0.60
1984	0.60	0.30	0.80	0.80	0.80	0.00	0.00	**0.80**				

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GOVERNMENT STATISTICS

AUSTRALIA

	Price Index of Materials Used in Manufacturing Industry—All Groups[1] (1969=100)	Award Rates of Pay Indexes Australia—Adult Males In Mining Wage Earners, Weekly Rates[2] (1976=100)
1983 Avg.	401.2	181.8
April 1983	407.3	180.9
May 1983	414.7	180.9
Jun 1983	415.6	181.0
Jul 1983	408.3	180.7
Aug 1983	403.0	180.7
Sep 1983	402.9	180.6
Oct 1983	397.5	188.3
Nov 1983	395.5	188.3
Dec 1983	399.2	188.1
Jan 1984	399.1	188.3
Feb 1984	402.4R	188.2
Mar 1984	403.8	188.0
Apr 1984	404.1R	195.6
May 1984	403.8R	196.4R
Jun 1984	404.8P	

CANADA

		Wage-earner Data: Average Hourly Earnings (C$)[2]					
	Industry Selling Price Index: Manufacturing[1] (1971=100)	Uranium Mines (SIC 057)	Metal Mines (SIC 051-059)	Mines, Quarries and Oil Wells[3] (SIC 051-099)	Primary Metal Industries Non-ferrous[4] (SIC 296)	(SIC 298)	Chemicals and Chemical Products[5] (SIC 372-379)
1983 Avg.	298.8	—	14.69	14.30	—	—	11.17
Jul 1983	300.4	16.48	14.35	13.93	11.70	9.83	11.04
Aug 1983	301.3	16.93	14.36	13.89	11.82	10.08	11.19
Sep 1983	301.1	17.66	14.90	14.41	11.99	10.32	11.29
Oct 1983	301.6	17.73	15.27	14.65	11.76	10.03	11.30
Nov 1983	301.8	17.82	15.29	14.67	11.78	10.62	11.38
Dec 1983	302.9	17.84	15.11	14.66	11.86	10.60	11.51
Jan 1984	305.4	17.74	15.27	14.74	11.91	10.84	11.69
Feb 1984	306.6	17.78	15.59	14.90	12.04	10.82	11.51
Mar 1984	308.7R	18.05	15.52	14.82	12.14	10.84	11.58
Apr 1984	310.4	18.06	15.83	15.10	11.96	10.34	11.63
May 1984	310.5	18.48P	15.64R	15.06R	12.11R	10.16R	11.65R
Jun 1984	310.8R	16.35P	15.09P	14.61P	12.27P	10.27P	11.67P
Jul 1984	312.3P	—	—	—	—	—	—

P = Preliminary R = Revised since last month

For annual averages prior to 1983, and for notes pertaining to these statistics, see pages 23-26 of Report 190 of June 1984.

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GOVERNMENT STATISTICS

REPUBLIC OF SOUTH AFRICA

	Average Declared Working Costs per per Metric Ton of Gold Ore Milled (Rand)[1]	Tonnage-Weighted Index of Average Working Costs per Metric Ton of Gold Ore Milled (March 1982=100)[2]	Consumer Price Index[3] (1975=100)[4]	Producer Price Index All Groups[5] (1975=100)	Total Employment in Mining and Quarrying (Code 35)[6]	Total Salaries and Wages in Mining and Quarrying (1,000 Rand) (Code 40)[6]
1983 Avg.	51.87	115.0	262.2	274.8	696,579	3,644,772
Jul 1983	—	—	262.5	273.7	704,202	314,566
Aug 1983	—	—	265.6	278.9	698,984	311,789
Sep 1983	52.92	117.4	267.3	279.4	696,435	312,264
Oct 1983	—	—	270.0	281.0	693,225	311,418
Nov 1983	—	—	271.4	281.6	688,459	317,485
Dec 1983	53.70	119.6	273.2	283.7	690,750	333,595
Jan 1984	—	—	274.7	283.3	689,807	326,619
Feb 1984	—	—	278.4	286.5	702,553	335,906
Mar 1984	55.30	123.1	281.9	288.0	715,628	342,332
Apr 1984	—	—	286.1	290.2	712,963	327,550
May 1984	—	—	288.3	292.6	710,040	327,937
Jun 1984	56.95R	126.2	291.2	295.1	—	—
Jul 1984	—	—	295.1	—	—	—

UNITED STATES

	Producer Price Index[1]		Consumer Price Index[2]	GNP Implicit Price Deflator[3]	Gross Average Hourly Earnings of Production or Non-supervisory Workers (US$)[4]			
	Industrial Commodities (1967=100)	All Commodities (1967=100)	(1967=100)	(1972=100)	Metal Mining (SIC 10)	Primary Non-ferrous Metals (SIC 333)	Chemicals and Allied Products (SIC 28)	Electric and Electronic Equipment (SIC 36)
1983 Avg.	315.8	303.1	298.4	215.63	12.57	13.43	10.59	8.65
Jun 1983	315.3	302.4	298.1	214.55	12.55	13.37	10.52	8.63
Jul 1983	316.5	303.2	299.3	—	12.59	13.56	10.59	8.67
Aug 1983	317.3	304.7	300.3	—	12.54	13.46	10.62	8.62
Sep 1983	317.1	305.3	301.8	216.44	12.62	13.46	10.70	8.73
Oct 1983	318.5	306.0	302.6	—	12.67	13.55	10.79	8.71
Nov 1983	318.3	305.5	303.1	—	12.64	13.56	10.86	8.77
Dec 1983	318.4	306.1	303.5	218.53	12.75	13.33	10.90	8.84
Jan 1984	319.1	308.0	305.2	—	12.67	13.38	10.91	8.88
Feb 1984	320.6	308.9	306.6	—	12.81	13.34	10.90	8.86
Mar 1984	321.9	311.0R	307.3	220.58	12.85	13.33	10.95	8.88
Apr 1984	322.5	311.4	308.8	—	12.98R	13.29R	10.97	8.89
May 1984	323.3	311.7	309.7	—	12.99R	13.37R	11.02R	8.89R
Jun 1984	323.9	311.4	310.7	222.33R	12.99P	13.41P	11.05R	8.91R
Jul 1984	324.0	312.0	311.7	—	—	—	11.14P	8.94P

P = Preliminary R = Revised since last month

For annual averages prior to 1983, and for notes pertaining to these statistics, see pages 23-26 of Report 190 of June 1984.

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